

PROCEEDINGS
OF
The Academy of Natural Sciences
OF
PHILADELPHIA
(Founded 1812)

VOLUME XCIV
1942

THE ACADEMY OF NATURAL SCIENCES
OF
PHILADELPHIA
1942

SEPARATES OF THE CONTRIBUTIONS PRESENTED IN THIS VOLUME OF
THE PROCEEDINGS MAY BE PURCHASED AT THE FOLLOW-
ING FIGURES, WHICH INCLUDE POSTAGE:

BOND, JAMES. Additional Notes on West Indian Birds. 18 pp.	\$.50
BOND, JAMES, AND RODOLPHE MEYER DE SCHAUSENSEE. The Birds of Bolivia. Part I. 85 pp.	2.55
DE SCHAUSENSEE, RODOLPHE MEYER. See BOND and DE SCHAUSENSEE.	
HARBISON, ANNE. See RICHARDS and HARBISON.	
MILLER, GERRIT S., JR. Zoological Results of the George Vanderbilt Sumatran Expedition, 1936-1939. Part V.—Mammals Collected by Frederick A. Ulmer, Jr. on Sumatra and Nias. 59 pp., 4 pls.	1.90
MYERS, FRANK J. The Rotatorian Fauna of the Pocono Plateau and Environs. 35 pp., 3 pls.	1.20
REHN, JAMES A. G. Notes on Species of the Locust Genus <i>Parasphena</i> , with Des- criptions of Three New Species (Orthoptera, Acrididae, Pyrgomorphinae). 20 pp., 6 text-figs., 2 pls.	.70
RHEN, JAMES A. G., AND JOHN W. H. REHN. A Review of the New World <i>Eumastacinae</i> (Orthoptera, Acrididae). Part II. 88 pp., 60 text-figs., 2 pls.	2.75
REHN, JOHN W. H. See REHN and RHEIN.	
RICHARDS, HORACE G., AND ANNE HARBISON. Miocene Invertebrate Fauna of New Jersey. 84 pp., 9 text-figs., 16 pls.	3.30

One hundred-thirteen papers of smaller size by a number of authors have appeared in Nos. 1 to 113 of the new serial "Notulae Naturae" issued between May 1939 and November 1942. This journal, made up of contributions of sixteen pages or less, is offered for subscription at \$3.50 per unit of fifty numbers. Individual papers can be purchased at prices ranging from twenty-five to fifty cents each, depending upon pagination and number of illustrations. A title page, contents, and index for Nos. 1 to 100 is now in preparation, and will be issued shortly to subscribers and exchanges.

Price lists, grouped by subjects, covering many of the contributions which have appeared in the Proceedings and Journal, will be supplied on request. Additional listings, now being prepared, will shortly make available many important papers on all branches of natural history hitherto not for sale as separates.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

19th and The Parkway, Philadelphia, Penna.

December 1942.

PROCEEDINGS
OF
The Academy of Natural Sciences

OF
PHILADELPHIA
(Founded 1812)

VOLUME XCIV
1942

PHILADELPHIA
THE ACADEMY OF NATURAL SCIENCES
1942

This One



PDTQ-AA8-R652

PUBLICATION COMMITTEE

JAMES A. G. REHN, *Chairman*

C. BERNARD PETERSON, *Editor*

CHARLES M. B. CADWALADER

BENJAMIN F. HOWELL

PHILIP P. CALVERT

FRANK J. MYERS

H. RADCLYFFE ROBERTS

CONTENTS

For Announcements, etc., see General Index

	PAGE
BOND, JAMES. Additional Notes on West Indian Birds. Pub. July 31, 1942	89
BOND, JAMES, AND RODOLPHE MEYER DE SCHAUENSEE. The Birds of Bolivia. Part I. Pub. Dec. 23, 1942	307
DE SCHAUENSEE, RODOLPHE MEYER. See BOND and DE SCHAUENSEE.	
HARBISON, ANNE. See RICHARDS and HARBISON.	
MILLER, GERRIT S., JR. Zoological Results of the George Vanderbilt Sumatran Expedition, 1936-1939. Part V.—Mammals Collected by Frederick A. Ulmer. Jr. on Sumatra and Nias. Plates 3-6. Pub. Nov. 13, 1942	107
MYERS, FRANK J. The Rotatorian Fauna of the Pocono Plateau and Environs. Plates 23-25. Pub. Dec. 2, 1942	251
REHN, JAMES A. G. Notes on Species of the Locust Genus <i>Parasphena</i> , with Descriptions of Three New Species (Orthoptera. Acrididae, Pyrgomorphinae). Plates 26-27, 6 figs. Pub. Dec. 9, 1942	287
REHN, JAMES A. G., AND JOHN W. H. REHN. A Review of the New World Eumastacinae (Orthoptera. Acrididae).—Part II. Plates 1-2, 60 figs. Pub. May 29, 1942	1
REHN, JOHN W. H. See REHN and REHN	
RICHARDS, HORACE G., AND ANNE HARBISON. Miocene Invertebrate Fauna of New Jersey. Plates 7-22, 9 figs. Pub. Nov. 25, 1942	167
—————	
Abstracts of the Minutes of the Proceedings	393

PROCEEDINGS
OF THE
ACADEMY OF NATURAL SCIENCES
OF
PHILADELPHIA

1942

A REVIEW OF THE NEW WORLD EUMASTACINAE
(ORTHOPTERA, ACRIDIDAE). — PART II

BY JAMES A. G. REHN¹ AND JOHN W. H. REHN²

The first part of this study appeared from the press in November 1939,³ and in it will be found the general introduction which should be read by the interested student. Acknowledgments for cooperation received there set forth apply with equal force to the present installment, with the addition of Cornell University to the institutions which have rendered assistance in this work.

The present section deals with a portion of the Group Eumastaces, the remainder of which will be treated in the third and last section of the study, which should be completed in the near future. For the characters of the various groups of the subfamily represented in Neogaea, reference should be made to the diagnostic key to the same given in Part One.⁴

In the present part of the review we are discussing 6 genera and 28 species and subspecies, of which we have seen all of the genera and all but 2 of the species. Of the genera considered 2 are here described as new, and of the species 14 are new. We have seen the types of all but 4 of the species and subspecies discussed, while 22 of the total of 28 forms are represented in the Philadelphia collections, and 17 of these by the types.

The forms treated in the present part are as follows: ⁵

¹ Curator, Department of Insects, Academy of Natural Sciences of Philadelphia.

² Research Associate, Department of Insects, Academy of Natural Sciences of Philadelphia, and Department of Entomology, Cornell University.

³ Proc. Acad. Nat. Sci. Phila., XCI, pp. 165-206, pls. 6-8. (November 6, 1939.)

⁴ Idem, pp. 168-169.

⁵ An asterisk before the species' name indicates that material has been examined. A dagger shows that the type has been studied.

GROUP EUMASTACES (section here studied)

Psychomastax Rehn and Hebard

- * † *P. psylla psylla* Rehn and Hebard. (California.)
- * † *P. psylla robusta* Hebard. (California and Nevada.)
- * † *P. psylla deserticola* Hebard. (California.)

Eumorsea Hebard

- * † *E. balli* Hebard. (Arizona.)

Morsea Scudder

- * † *M. californica californica* Scudder. (California.)
- * † *M. californica dunicola* Rehn and Hebard. (Arizona and Nevada.)
- * † *M. californica tamalpaisensis* Rehn and Hebard. (California.)

Temnomastax new genus

- T. saurus* (Burr). (Eastern Brazil.)
- * † *T. beni* new species. (Amazonian Bolivia.)
- * † *T. hamus* new species. (Minas Geraes, Brazil.)
- * † *T. latens* new species. (Minas Geraes, Brazil.)
- * † *T. chiquitos* new species. (Santa Cruz region of Bolivia.)
- * *T. borellii* (Giglio-Tos). (Eastern Bolivia, southern Brazil and Paraguay.)
- * *T. tigris* (Burr). Interior southern Brazil, Paraguay and extreme northern Argentina.)

Masyntes Karsch

- * † *M. camaguei* new species. (Central Cuba.)
- * † *M. gundlachii* (Scudder). (Guantanamo area, Cuba.)
- * † *M. macaca* new species. (Mountains of eastern Cuba.)
- * † *M. meddix* new species. (Coast of Oriente Province, Cuba.)
- * † *M. poeyi* new species. (Western Cuba.)
- * † *M. exitus* new species. (Extreme eastern Cuba.)

Eumastacops new genus*Arawakella* new subgenus

- * † *E. unca* new species. (British Guiana and Amazonian Brazil.)

Eumastacops s. s.

- * † *E. trifida* new species. (British Guiana.)
- * † *E. nemorivaga* new species. (Amazonian Brazil and Bolivia.)
- * † *E. militaris* (Gerstaecker). (Amazonian Brazil.)
- * † *E. plebeja* (Gerstaecker). (Amazonian Brazil.)
- E. versicolor* (Burr). (Paraguay.)
- * † *E. parishi* new species. (British Guiana and Amazonian Brazil.)
- * † *E. caligo* new species. (Amazonian Brazil.)

GROUP EUMASTACES

Eleven genera can be recognized in this exclusively New World group, all of which have been available to us in the present study. These genera align themselves through various characteristics into eight categories, which may be indicated as follows:

- A. *Psychomastax* Rehn and Hebard, and *Eumorsea* Hebard.
- B. *Morsea* Scudder.
- C. *Temnomastax* new genus.
- D. *Masyntes* Karsch.
- E. *Eumastacops* new genus.
- F. *Pseudomastax* C. Bolívar.
- G. *Paramastax* Burr.
- H. *Eumastax* Burr, *Caenomastax* Hebard, and *Santanderia* Hebard.

Of these categories C, E, F, G, and H are entirely Neotropical, with all except H as far as known limited to South America, D occurs only in Cuba, while A and B are Nearctic.

The Nearctic genera have been quite fully treated by Rehn and Hebard and by Hebard, and the Central American forms of *Eumastax* by Rehn and Rehn. References to their respective papers are given under the individual genera.

The Group Eumastaces clearly has gone through its evolution in Neogaea, at least back to a relatively primitive ancestor. Our impressions of the probable history of *Temnomastax* and *Masyntes* are presented in some detail on succeeding pages under the respective genera. Briefly, we consider that *Masyntes* is a most divergent stock and probably was the first to diverge, chronologically speaking, from a common ancestral stem, which we postulate existed on the old Central American land-mass. From this *Masyntes* moved relatively early into the West Indies, where it has since been cut off, its evolution perhaps slowed up by lack of competition and its areal distribution there probably reduced. The ancestors of *Temnomastax* probably moved southward from Central America into South America upon the reestablishment of the Panama land-bridge in the Upper Miocene or Lower Pliocene. The genera of present Nearctic distribution probably moved northward in relatively recent times, very probably Post-Pleistocene at the earliest.

The probable history of the other genera seems less clearly evident, although indications of a common ancestry are unmistakable. Their present development and differentiation would seem to indicate that *Eumastacops*, *Pseudomastax* and *Paramastax* have gone through much of their evolution in or near their present general habitat. If a Central American ancestry is correct for these genera, and such is our conviction, then their antecedent

stock or stocks moved into South America prior to the Upper Eocene, when the Panama portal was opened according to the geologists, or not until the Upper Miocene or Lower Pliocene, when the Panama land bridge was re-established. It is very probable that much of their evolution since either period has been influenced to a considerable degree by the slow upsurge of the Andes. Three of these and associated genera (*Paramastax*, *Caenomastax* and *Santanderia*) show in some or all of their montane species features which in other groups are often alar adaptive responses to montane conditions, yet one lowland *Eumastax* and a similar *Eumastacops* are subapterous in both sexes. The genus *Eumastax* may possibly have extended its distribution into South America much more recently than the period when the postulated ancestors of *Eumastacops*, *Pseudomastax*, and *Paramastax* moved southward. The known diversity of *Eumastax* in parts of Central America is as great as that found in any part of South America of far greater size, which would seem to indicate the genus may have gone through much of its evolution north of Panama. In parts of South America which have produced marked specific diversity in other genera of the group, as *Eumastacops*, *Pseudomastax* and *Paramastax*, *Eumastax* is less diverse, and with proportionately much fewer specific types than in the much smaller area of Central America.

Key to the Genera of the Group Eumastaces

1. Fastigio-facial junction angulate or subangulate produced, with a transverse carina, a dorsal pair of elevated nodes or at least a definite fastigio-facial angular delimitation and not a regular arcuation, the junction being clearly visible dorso-cephalad of eyes when viewed in lateral aspect. Lateral margins of frontal costa not arcuately continuous with those of fastigium.....2
- Fastigio-facial junction not angulate or subangulate, not at all or but faintly produced, without a transverse carina, paired dorsal nodes or any definite angular delimitation, nearly or quite arcuate in its passage from the facial line to that of fastigium, the junction little if at all visible dorso-cephalad of eyes when viewed in lateral aspect. Lateral margins of frontal costa in general arcuately continuous with those of fastigium.⁶9
2. Frontal costa relatively broad, at narrowest interocellar point broader than proximal antennal article. Apterous. Antennae with 12 articles.....3
- Frontal costa narrow, at narrowest interocellar point definitely narrower than proximal antennal article. Apterous (*Morsea* and *Temnomastax* in part), brevialate or macropterous. Antennae with 12 or 13 articles. (Caudal tarsal claws always markedly unequal in length.)4

⁶ These are rarely subangulate and weakly elevated where they pass from face to vertex (as in *Santanderia* and *Caenomastax*), but never sufficiently so to be confused with the opposite category.

3. Form moderately robust. Caudal tarsal claws not markedly unequal in length. Face not strongly declivent, subvertical in female; fastigio-facial angle laterad with definite parts of a transverse carina.

Psychomastax Rehn and Hebard

Form more slender. Caudal tarsal claws markedly unequal in length. Face more markedly declivent; fastigio-facial angle laterad with but weak indications of a transverse carina. *Eumorsea* Hebard

4. Apterous, brevialate or macropterous; if latter, the wings are hyaline. Face less vertical, more declivent; fastigium in profile more definitely projecting cephalad and more broadly visible dorsad of eyes. Form comparatively slender 5

Macropterous; tegmina and wings tinted, the former often in part opaque and frequently with a tessellate pattern, produced by contrast of arcolelets and venation. Face more vertical, less declivent; fastigium in profile less definitely projecting cephalad and less broadly visible dorsad of eyes. Form comparatively robust. (Coloration often strongly contrasted.) *Pseudomastax* C. Bolivar

5. Fastigium with its transverse outline more or less distinctly divided in two by a medio-longitudinal impression, which severance may be strongly enough marked to produce a bimammillate appearance. . . 8

Fastigium with its transverse outline not severed by a medio-longitudinal impression, the margin being entire and arcuate or arcuotruncate as seen from dorsum. 6

6. Apterous 7

Alate to brevialate (apterous in *Temnomastax saurus*). (Pronotum distinctly sellate, ventro-caudal angles of lateral lobes acute-produced caudad. Genicular lobes of caudal femora spinose as well as the median and lateral points of femoral apex.) . . *Temnomastax* new genus

7. Pronotum distinctly sellate, ventro-caudal angle of lateral lobes acute produced caudad. (Genicular lobes of caudal femora spinose, as well as the median and lateral points of femoral apex.)

Temnomastax saurus (Burr)

Pronotum not distinctly sellate, ventro-caudal angle of lateral lobes not acute-produced caudad, instead rounded rectangulate or obtuse. (Fastigio-facial angle strongly acute produced. Caudal femora with apex armed with a medio-dorsal and dorso-lateral minute spines, as are the genicular lobes. Antennae with 13 articles, the tenth bearing the usual tooth. Male cerci falcate; male ultimate sternite (subgenital plate) with a linguiform process in its medio-dorsal section.)

Morsea Seudder

8. Apex of fastigium sharply divided into two lateral cariniform areas. Pronotum strongly longitudinal, less sellate, with oblique strumae on lateral lobes. Brevialate or subapterous. Caudal tarsi with second article not less than half as long as proximal one (metatarsus).

Masyntes Karsch

Fastigium less sharply divided into two submammiform nodes. Pronotum less definitely longitudinal, more sellate, lacking oblique strumae on lateral lobes. Fully alate or brevialate (one species

only). Caudal tarsi with second article never more (usually much less) than half as long as proximal article (metatarsus).

Eumastacops new genus

9. Fully alate10
- Apterous, subapterous or brevialate12
10. Wings (in male) cycloid, opaque, white. (Anal field of tegmina very closely and irregularly areolate proximad. Ventro-caudal angle of lateral lobes of pronotum very sharply acute prolonged caudad.)
Paramastax Burr (In part)
- Wings normal in both sexes, not definitely cycloid, sometimes tinted but never opaque, never white11
11. Tegmina and wings hyaline, latter clear hyaline; tegminal venation as a whole never pale contrasted against a darker background. Pronotum not definitely sellate, almost always deplanate or subdeplanate dorsad; disk usually with traces of incomplete lateral carinae, frequently on metazona alone. Penultimate abdominal tergite of male never developed caudo-laterad into marked infracereal extensions. Form as a whole slender.....*Eumastax* Burr (In part)
- Tegmina and wings colored, the former often subopaque with venation pale contrasted against a darker background. Pronotum definitely sellate; disk without traces of lateral carinae. Penultimate abdominal tergite of male developed caudo-laterad into marked infracereal extensions which border the penultimate sternite. Form as a whole more robust.*Pseudomastax* C. Bolivar
12. Tegmina variously developed on a reduced scale, but never merely minute lobiform pads. Wings present on greatly reduced scale or lacking.13
- Tegmina, if present, merely minute lobiform pads. Wings lacking..15
13. Ventro-caudal angle of lateral lobes of pronotum acute-produced caudad. Cerci of male sharply incurved distad. (Caudal margin of pronotum obtuse-angulate emarginate to angulate produced.)
Paramastax Burr (In part)
- Ventro-caudal angle of lateral lobes of pronotum not acute-produced caudad. (Caudal margin of pronotum never obtuse-angulate emarginate.)14
14. Tegmina not coriaceous, with venation normal in type for Eumastaces, surface never cribrately areolate, apices rounded. Wings developed proportionately with tegmina. Lateral lobes of pronotum with caudal margin nearly or quite straight.....*Eumastax* Burr (In part)
- Tegmina coriaceous, with definite venation almost entirely limited to the humeral trunk, surface cribrately areolate, apices sharply or moderately acuminate. Wings rudimentary or lacking. Lateral lobes of pronotum with caudal margin quite definitely arcuate or subsigmoid.*Caenomastax* Hebard
15. Lateral lobes of pronotum with ventro-caudal angle acute-produced caudad.⁷*Paramastax* Burr (In part)

⁷ Occasionally (i.e. *Paramastax chopardi*) there is but little production; the angle, however, is definitely although not conspicuously acute.

- Lateral lobes of pronotum with ventro-caudal angle not produced caudad, never sharper than rectangulate.....16
16. Eyes prominent and globose in both sexes. Both sexes with lobiform tegminal pads. Median carina of pronotum not distinctly and continuously indicated, ultimate sternite (subgenital plate) of female with distal margin not spinulose.....*Eumastax* Burr (In part)
- Eyes little prominent, not globose. Male with lobiform tegminal pads, female apterous. Median carina of pronotum distinctly and continuously indicated. Ultimate sternite (subgenital plate) of female with distal margin spinulose.....*Santanderia* Hebard

PSYCHOMASTAX Rehn and Hebard

1918. *Psychomastax* Rehn and Hebard, Trans. Amer. Entom. Soc., XLIV, pp. 225, 242.
1934. *Psychomastax* Hebard, Trans. Amer. Entom. Soc., LIX, p. 363.

Genotype (by original designation).—*P. psylla* Rehn and Hebard.

A key to the various forms of the single known species is included in Hebard's 1934 study of the genus, as well as many habitat notes.

Psychomastax psylla psylla Rehn and Hebard

1918. *Psychomastax psylla* Rehn and Hebard, Trans. Amer. Entom. Soc., XLIV, p. 243, pl. XI, fig. 1, pl. XII, figs. 1, 5, 9, 11, 15, 17 and 19, pl. XIII, figs. 1, 5, 7 and 9. [♂, ♀; Strawberry Valley, San Jacinto Mountains, California.]
1934. *Psychomastax psylla psylla* Hebard, Trans. Amer. Entom. Soc., LIX, pp. 364, 365, pl. XXII, figs. 1 and 2.

This form of the species is limited in its distribution to certain of the mountain areas of southern and south-central California (i. e. Ventura, San Bernardino and San Jacinto Ranges) and has also been taken at Round Valley, Inyo County, California.

Psychomastax psylla robusta Hebard

1934. *Psychomastax psylla robusta* Hebard, Trans. Amer. Entom. Soc., LIX, pp. 364, 365, pl. XXII, figs. 3 and 4. [♂, ♀; Charleston Peak, Spring Mountain Range, Nevada.]

The range of this subspecies is known to cover several of the mountain ranges of south-central and southern Nevada (i. e. Belted and Spring Mountain Ranges), certain desert mountain areas of California (Panamint and White Mountains) and the eastern slope of the Sierra Nevada of the same state. This subspecies ranges into the most boreal condition known to be inhabited by any New World member of the subfamily, reaching the Hudsonian Zone at 10,700 feet in the Sierra Nevada.

Psychomastax psylla deserticola Hebard

1934. *Psychomastax psylla deserticola* Hebard, Trans. Amer. Entom. Soc., LIX, pp. 364, 365, pl. XXII, figs. 5 and 6. [♂, ♀; Cushenbury Ranch, San Bernardino County, California.]

The northern slope of the San Bernardino Mountains of California, between 4100 and 5900 feet, is the region from which this subspecies is known.

EUMORSEA Hebard

1935. *Eumorsea* Hebard, Trans. Amer. Entom. Soc., LXI, p. 119.

Genotype (by original designation).—*E. balli* Hebard.

But a single species of this interesting genus is known.

Eumorsea balli Hebard

1935. *Eumorsea balli* Hebard, Trans. Amer. Entom. Soc., LXI, p. 119, pl. IV, figs. 8-11. [♂, ♀; Ramsey Canyon, Huachuca Mountains (type locality); Carr Canyon, Huachuca Mountains and Mount Graham, Pinaleno Mountains, Arizona.]

The localities given in the original description, all in mountain areas of southeastern Arizona, cover our present knowledge of the distribution of this genus and species.

MORSEA Scudder

1898. *Morsea* Scudder, Psyche, VIII, p. 179.

1918. *Morsea* Rehn and Hebard, Trans. Amer. Entom. Soc., XLIV, pp. 225, 226.

Genotype (by monotypy).—*M. californica* Scudder.

A key to the subspecies of the sole species known in the genus was presented by Rehn and Hebard in 1918. In that paper will be found extensive observations on the species' habits and seasonal occurrence.

Morsea californica californica Scudder

1898. [*Morsea*] *californica* Scudder, Psyche, VIII, p. 179. [♂; Mount Wilson, San Gabriel Range (type selected by Rehn and Hebard⁸) and Cahon Pass, between San Gabriel and San Bernardino Mountains, California.]
1909. *Morsea californica* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1909, p. 420, figs. 6 and 7.
1918. *Morsea californica californica* Rehn and Hebard, Trans. Amer. Entom. Soc., XLIV, p. 229, pl. XI, fig. 2, pl. XII, figs. 2, 6, 10, 12, 16, 18 and 20, pl. XIII, figs. 2, 6, 8 and 10.

The typical form of the species is known to occur in many of the mountain ranges of southern and south-central California, from as far north as Paso Robles Hot Springs, south to the Mexican border and east to the San Bernardino and San Jacinto Mountains. Material from between Paso Robles Hot Springs and the San Francisco Bay region is seen to intergrade into *M. c. tamalpaisensis*, and has been discussed in detail by Rehn and Hebard.

Morsea californica dumicola Rehn and Hebard

1918. *Morsea californica dumicola* Rehn and Hebard, Trans. Amer. Entom. Soc., XLIV, pp. 229, 235, pl. XI, figs. 3, 7 and 13, pl. XIII, fig. 3. [♂, ♀; Prescott, Yavapai County, Arizona.]

This subspecies occurs in various areas of the Great Basin and Arizona Plateau regions reaching from eastern and southeastern Nevada to central Arizona.

⁸ Trans. Amer. Entom. Soc., XLIV, p. 229, (1918).

Morsea californica tamalpaisensis Rehn and Hebard

1909. *Morsea californica tamalpaisensis* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1909, p. 421, figs. 3, 4 and 5. [♂, ♀; Mount Tamalpais, Marin County, California.]

1918. *Morsea californica tamalpaisensis* Rehn and Hebard, Trans. Amer. Entom. Soc., XLIV, pp. 229, 239, pl. XII, figs. 4, 8 and 14, pl. XIII, figs. 4 and 11.

This northern subspecies is known only from the upper slopes (elevation 1500 to 2586 feet) of Mt. Tamalpais in the Coast Range of California to the north of San Francisco Bay. It will, doubtless, be found on numerous other mountain areas in the same general region. South of San Francisco Bay this subspecies intergrades into typical *M. californica*.

TEMNOMASTAX ⁹ new genus

1899. *Masyntes* Burr, Anales Soc. Españ. Hist. Nat., XXVIII, pp. 95, 273. (In part.)

1903. *Masyntes* Burr, Genera Insectorum, Orth., Eumastacidae, pp. 15 and 17. (In part.)

The species occurring in portions of South America formerly referred to *Masyntes* must be separated generically from *Masyntes gundlachii*, the genotypic species of that genus, which latter, as far as at present known, is limited in distribution to the island of Cuba.

The preceding key to the genera stresses the major features distinguishing these two quite distinct assemblages, one of which is here described as new. One of the most striking characters to separate the genera is the undivided and transversely arcuate or subarcuate cephalic fastigial border in *Temnomastax*, while the same area in *Masyntes* is definitely divided in two by a medio-longitudinal impression, continuing the frontal costa sulcation, and which by breaking the transverse outline of the fastigium produces subparallel lateral cariniform areas on the latter. The proximal article (metatarsus) of the caudal tarsi is also longer than the third in *Temnomastax*, instead of subequal as in *Masyntes*. Further, in *Temnomastax* there is no indication of the oblique, cicatriform carinate ridges seen on the lateral lobes of the pronotum in both sexes of *Masyntes*.

In a number of features *Temnomastax* is nearer to the Nearctic genera *Morsea* and *Eumorsea* than it is to any others known, and in a division of the Eumastaces into subgroups would be placed between these genera and *Masyntes*.

Generic Characters.—Apterous to fully alate. Form subcompressed, apex of male abdomen subrecurved. Fastigium cut off from face, entire, undivided, seen from dorsum slightly produced arcuate cephalad of eyes and transversely subcarinate, in lateral view the fastigio-facial angle is subacute, occasionally (in females) with a transverse sulcation ventrad of angle; occiput definitely arcuate ascendent to the little-narrowed interocular vertex; face strongly retreating; frontal costa narrow, evenly pronounced and continuously sulcate from the smooth fastigial venter to the

⁹ From *τέμνω*, *stump*, and *μάσταξ*, *Mastax*, in allusion to the relatively truncate fastigium as seen from the dorsum.

clypeal suture, distinctly compressed in the inter-ocellar region. Eyes ovoid, but moderately prominent. Antennae twelve-jointed, weakly depressed and subspatulate distad.

Pronotum sellate, median carina of disk finely and continuously indicated, cephalic margin of disk subarcuate, caudal margin definitely convex; lateral lobes longitudinal, deeper caudad, ventro-caudal angle acute-produced caudad to a variable degree.

Tegmina absent (*saurus*) or present, when present ranging from elongate elliptical slips, subequal to the pronotum in length, to fully developed organs of flight reaching to apices of caudal femora, venation of the normal type for the Eumastaces in fully macropterous individuals, the principal veins equally evident in the reduced tegminal condition. Wings absent (*saurus*) or developed nearly (in reduced tegminal condition) or quite as fully as the tegmina, the venation imperfectly (in reduced tegminal species) or fully developed (macropterous species).

Prosternum with converging carinulae fusing in a median transverse carinula; meso-metasternum with a cephalic cingulate marginal carination, rounding laterad and extending caudad to (*beni*) or distinctly caudad of the caudal margin of the mesosternum; interspace between mesosternal lobes transversely subcuneate, metasternal lobes broadly in contact and with interstitial suture subobsolete.

Abdomen with apex in male moderately recurved and subclavate; male cerci undivided, apically attenuate and hooked, strongly recurved or distad truncate; ultimate sternite (subgenital plate) of male undivided, produced distad to a greater or lesser degree, ventro-proximal portion with broad membranous area adjacent to penultimate sternite; disto-dorsal margins forming an acute angulation as viewed in dorsal aspect.

Cephalic and median limbs slender, cephalic femora with paired dorsal carinulae, these distad each with a marginal spine, weakly, if at all, carinulate on ventro-cephalic margins, rounded ventro-caudad, no marginal lamellations or dentate lobes, cephalic genicular lobe roundly produced, unarmed, caudal genicular lobe hardly at all developed; median femora with margins, spines and genicular lobes as in cephalic femora; caudal femora slender, margins carinate and in part subserrulate but unspined, apices of the genicular lobes, genicular arches and distal extremity of the medio-dorsal carina brevispinulose; caudal tibiae with 21 to 25 spines on the externo-extensor margin and 22 to 25 on the interno-extensor one, the spines on the latter biseriate in length; internal calcaria with extensor one many times longer than flexor one, much larger than the distal spine of the interno-extensor tibial group, but definitely shorter than the longest one of the same series; caudal tarsi with metatarsus one and one-third or more times as long as the third tarsal article, the three metasternal ventral pulvilli deplanate, the proximal much more widely separated from the others than they are from one another, dorsal surface of metatarsus longitudinally impressed, the elevated lateral margins chaetiferous and obscurely serrulate but not spinulose, external distal both marked or absent (*beni* only); tarsal claws unequal in length, the caudal in each pair the longer; arolia well developed.

Genotype.—*Temnomastax tigris* (*Masyntes tigris*) (Burr).

Remarks.—The relationship of *Temnomastax* on one hand to the Nearctic eumastacids, and on the other to the Cuban genus *Masyntes*, is indicative of a common ancestry, and perhaps one of considerable antiquity. Of the involved genera *Masyntes* is the most divergent, and in a number of features it stands well off from the others. From this we are warranted in concluding it probably was the first to diverge from a common ancestral stock. The center of specific differentiation of *Temnomastax*, at least as we at present know it, is on the relatively old plateau area and the upper Paraguay basin of Brazil, yet we feel quite strongly that there it is a derived, and not a fundamentally autochthonous, type. It is probable that the region in which the primitive type developed was the old Central American land-mass; that thence *Masyntes*, or at least its ancestral predecessor, moved into the Antilles, whether directly to Cuba or by way of the Honduran-Jamaican-Hispaniolan land-bridge and into Cuba secondarily is less important; that the ancient *Temnomastax* stock moved southward, possibly in the Upper Miocene or Lower Pliocene, across the Panama land-bridge, and through the Andean area, then probably slowly lifting, or into the old Guianan mountain mass, thence in a period less humid than most of the Pleistocene or Recent it reached the present Brazilian habitat, since peripherally spreading somewhat from that area. Perhaps *T. beni*, a quite divergent type, may have become segregated before the group had quite reached the area of its present greatest diversification. The Nearctic genera, under the same urge, may have moved northward, crossed Tehuantepec in the Upper Pliocene and entered the present area of the United States quite recently, probably with the onset of drier conditions at the close of the relatively humid Pleistocene.

Against this argument may be cited the facts that we have no relatives of *Masyntes* in the other Greater Antilles, that we have no *Temnomastax*-like genera in Central America, and no material indication of the postulated northward trek of *Psychomastax*, *Eumorsea*, and *Morsea*, or the similar southward one of *Temnomastax*. The answer to all of these exceptions would be that our knowledge of existing forms of this group, like that of so many others, is exceedingly fragmentary. Fifty years ago we knew but one eumastacid species from north of the Isthmus of Panama, the Cuban *Masyntes gundlachi*, while to-day we have evidence that twelve genera of the Eumastacinae occur in this area, all but one peculiar to it, with more than thirty known species or subspecies. Of these genera three have been obtained by field work of the last five years, five in that of the last twelve years. To-day we are entirely without knowledge of the Eumastacinae of northern and north-central Mexico (aside from Baja California), and merely a beginning has been made in obtaining a proper understanding of the Central American members of the subfamily.

Key to Species

Known Males

1. Apterous. Cerci of male straight and conical. (State of Bahia, Brazil.)
saurus (Burr)
Tegmina and wings developed to degrees ranging from abbreviated elliptical pads to fully functional flight organs in length exceeding the apex of the abdomen2
2. Fastigium of male extending cephalad of eyes a distance definitely more than half of fastigial width. Caudal margin of penultimate abdominal sternite of male with distal margin bisemarginate and having a definite median angulate production. Caudal metatarsus without disto-dorsal external tooth. Male ultimate sternite (subgenital plate) with a median elongate fistuliform rostration. Tegmina and wings with their length greater than that of the caudal femora. (Cerci of male tapering, falciform, decurved.) (Rio Beni, Bolivia.) ..*beni* new species
Fastigium of male extending cephalad of eyes a distance definitely less than half of fastigial width. Caudal margin of penultimate abdominal sternite of male with distal margin transversely truncate or concave, depending on angle of view, never with a median angulate production. Caudal metatarsus with disto-dorsal external tooth. Male ultimate sternite (subgenital plate) with at most a brief median rostration. Tegmina and wings variable in length, but never with their length greater than that of the caudal femora.3
3. Cerci of male with apices attenuate and sharply hooked, recurved so completely they are directed proximad. Ultimate sternite (subgenital plate) of male subrostrately produced mesad. Tegmina of male but slightly, if at all, longer than the pronotal dorsum. (State of Minas Geraes, Brazil.)*hamus* new species
Cerci of male with apices oblique truncate or subtruncate, never sharply recurved or attenuate. Ultimate sternite (subgenital plate) of male not truly subrostrate produced mesad (its dorsal margins as seen from dorsum convexly or straight convergent, never concavely so). Tegmina of male at least one and one-half times as long as the pronotal dorsum.4
4. Cerci of male less compressed, lacking a definite dorso-proximal lamellate flange, as seen from dorsum the distal half of cercal shaft is distinctly and regularly incurved. Tegmina and wings of male reaching to apex of ultimate tergite (supra-anal plate). (State of Minas Geraes, Brazil.)*latens* new species
Cerci of male more compressed, with a definite dorso-proximal lamellate flange, as seen from dorsum the shaft is at most but briefly inbent in distal fourth. Tegmina and wings of male not reaching to the ultimate tergite (supra-anal plate)5
5. Tegmina in male not over one and one-half times as long as the dorsum of the pronotum. Male cerci with dorso-proximal flange less extensive, less cultriform, the whole broader distad and with apical obliquity

ventrad developed into a distinct dentate production. (Paraguay and Matto Grosso, Brazil.) *borellii* (Giglio-Tos)

Tegmina in male as much as three times as long as the dorsum of the pronotum. Male cerci with dorso-proximal flange more extensive and cultriform, the whole narrower distad and with apical obliquity ventrad subacute but not distinctly dentate produced. (Paraguay; Matto Grosso, Brazil, and Salta, Argentina.) *tigris* (Burr)

Known Females

1. Apterous. (State of Bahia, Brazil.) *saurus* (Burr)

Tegmina and wings developed to degrees ranging from abbreviate elliptical pads to organs approximately half as long as the abdomen....2

2. Caudal margin of ultimate sternite (subgenital plate), as seen from venter, as a whole transversely truncate. Size larger. (Tegmina not over two and one-half times as long as the pronotal disk.) (Paraguay; Matto Grosso, Brazil, and Salta, Argentina.) *tigris* (Burr)

Caudal margin of ultimate sternite (subgenital plate), as seen from venter, more or less decidedly acute-produced mesad. Size smaller...3

3. Caudal margin of ultimate sternite (subgenital plate), as seen from venter, with its angulate production median and relatively minor, not involving the entire margin. Tegmina over three times as long as the pronotal disk. (State of Minas Geraes, Brazil.) *latens* new species

Caudal margin of ultimate sternite (subgenital plate), seen from venter, as a whole strongly angulate produced. Tegmina little, if any, longer than the pronotal disk.4

4. Caudal margin of ultimate sternite (subgenital plate), as seen from venter, with the converging sides of the production definitely sigmoid and the median production rectangulate. Outline of fastigium, as seen from dorsum, subtruncate mesad, arcuate laterad. Eyes slightly more prominent in cephalic aspect. (Paraguay; Matto Grosso, Brazil, and eastern Bolivia.) *borellii* (Giglio-Tos)

Caudal margin of ultimate sternite (subgenital plate), as seen from venter, with its halves virtually straight convergent to near the apex, which is moderately acute. Outline of fastigium, as seen from dorsum, obtuse-angulate mesad. Eyes slightly less prominent in cephalic aspect. (Eastern Bolivia.) *chiquitos* new species

Distribution.—From the states of Bahia, Espirito Santo and Minas Geraes, Brazil, westward at least to the upper course of the Rio Beni, northern Bolivia (Rurrenabaque), southward over interior Brazil (State of Matto Grosso) and southeastern Bolivia (Provincia Sara) to Paraguay (San Pedro) and extreme northern Argentina (Embarcacion, Salta).

Temnomastax saurus (Burr)

1899. *Masyntes saurus* Burr, Anales Soc. Españ. Hist. Nat., XXVIII, pp. 274, 277. [♂, ♀; Bahia, Brazil (type locality); Espirito Santo, Brazil.]

1913. *Scirtomastax brasiliensis* Bruner, Ann. Carneg. Mus., VIII, p. 429. [♀; Rio Sapão, State of Bahia, Brazil.]

This species is known to us only from the literature. It differs from the other members of the genus in its apterous condition. The type of *saurus* is in the Brunner Collection now at the Vienna Museum.

The synonymy of Brunner's *Scirtomastax brasiliensis* is clearly evident. That author apparently was misled by the apterous condition of the species and disregarded the character of the vertex. The genus *Scirtomastax* has been shown by recent studies¹⁰ to be an unnatural assemblage, erected upon an apterous condition, which by itself is not at all a diagnostic generic character in the Eumastaces, instead found present in species of quite a few genera of the group. Bruner's generic assignment of *brasiliensis* is thus of no assistance in placing his species. His statement that the vertex is "subangulate, a little advanced beyond the upper extremity of the eyes" quite definitely removes his species from the neighborhood of the genotype of Saussure's *Scirtomastax* (i. e. *S. cordillerae* = *Paramastax cordillerae* as here understood), even though his very superficial comparisons were made with that form. The description of *Scirtomastax brasiliensis* is so weak in differential features of value that almost no help can be drawn from it. The single definite (fastigial) feature given, and the agreement in other respects with the description of *saurus* except in the slightly greater size of *brasiliensis* and the antennal coloration, warrant the synonymy of the name. The size difference may be a local condition, almost equalled in the variation in the same dimensions here given for the congeneric *T. tigris*; while the antennal coloration difference can readily be due to methods of preservation.

The species *saurus* apparently ranges from the state of Bahia to that of Espirito Santo, and westward in the former to its extreme northwestern part (Rio Sapão).

Temnomastax beni¹¹ new species

Text-figures 1, 7, 12.

This striking species, of which, however, but the male sex is known, can at once be distinguished from the other members of the genus by the fully developed tegmina and wings, which well surpass the apex of the abdomen and reach to the apices of the caudal femora, by the more protuberant fastigium as seen both from the dorsum and in profile, the bisemarginate and mesad angulate produced caudal margin of the penultimate sternite of the male, and the strikingly produced and spout-like ultimate sternite (subgenital plate) of the same sex. The cercal form will, in addition, at once distinguish *beni* from *saurus*, *latens*, *borellii*, and *tigris*, while the apices of the cerci are much less recurved than in *hamus*, although of somewhat similar general type.

¹⁰ See Hebard, Trans. Amer. Entom. Soc., XLIX, p. 186, (1923); Proc. Acad. Nat. Sci. Phila., LXXXVI, pp. 157-158, (1924).

¹¹ From the Beni River of the Amazonian section of northern Bolivia, where the species is found.

Type.—♂; Rurrenabaque,¹² Rio Beni, Bolivia. December, 1921. (Mullford Biological Expedition; W. M. Mann.) [United States National Museum.]

Size medium; form slender, fully alate.

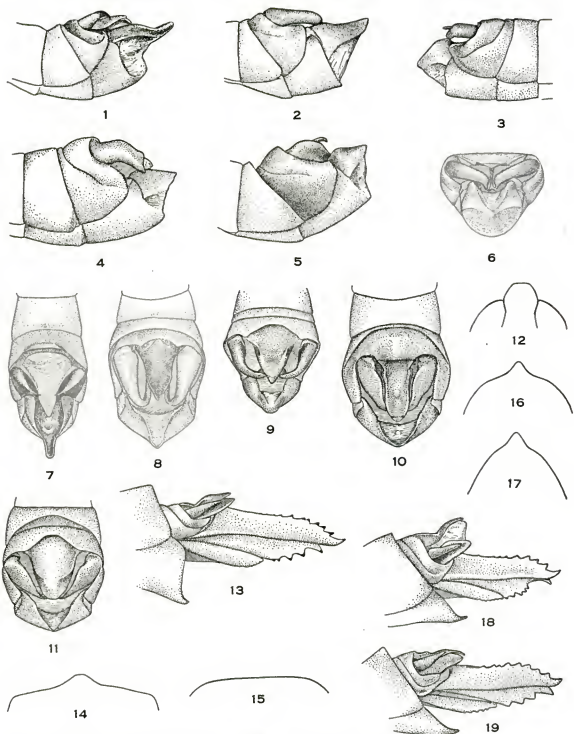
Head with occiput subarcuately ascending to the fastigial apex, dorsal length of head slightly greater than dorsal length of pronotum: fastigium as seen from dorsum definitely produced, its length cephalad of cephalic border of eyes contained one and four-fifths times in greatest fastigial width as seen from dorsum (as 9 to 17), the lateral portions of the margin moderately arcuate convergent cephalad and subtruncate distad, the lateral sections appreciably cingulate, the whole fastigium in cross-section arcuatotectate; in profile the fastigium is very definitely produced dorso-cephalad of the eyes, its extent subequal to one-fourth the greatest (oblique) dimension of the eye, rounded acute in outline: head in cephalic view with breadth across ventral portion of genae but faintly less than that across eyes; frontal costa definite but greatly narrowed and between the paired ocelli and antennal bases with the cariniform margins in contact, these gently diverging thence dorsad to the base of the fastigial peduncle, ventrad of the median ocellus the costa is less deeply sulcate yet with the margins no more distant than at the infra-fastigial end of the costa; lateral (accessory) facial carinae distinct and rather sharply cut: in profile facial line is strongly retreating with a low arcuation between antennal bases. Eyes relatively prominent, in profile with outline ovate, width to length as 3.8 to 5.5. Antennae short, twelve-segmented, the proximal one subequal in length to the second and third together, from third segment distad appreciably broadening to the tenth, eleventh and twelfth forming an acute apex, distal half of antenna appreciably depressed.

Pronotum markedly sellate, a low but definite median carina present on disk, cephalic margin of same as a whole distinctly concave, subtruncate mesad, caudal margin strongly and evenly convex; disk surface passing into that of lateral lobes without interruption except for rounded metazonal shoulders, surface of metazona cribrosely impresso-punctate: lateral lobes longer than deep, regularly increasing in depth caudad, ventro-cephalic angle rounded, ventral margin sinuately oblique, caudal margin subvertical, shallowly concave, ventro-caudal angle acute, appreciably produced.

Tegmina elongate, in length exceeding that of the caudal femora by nearly that of the pronotum, the tegminal apices markedly surpassing the abdominal apex and reaching to the caudal femoral apices, the distal portion in lateral aspect when closed subspatulate, the greatest width there little less than the length of the pronotum; apex semi-ovately rounded; venation simple, anterior ulnar vein definitely fusing with anal faintly distad of middle, median vein with a definite and sharp bifurcation, within which the areolae may be undivided and large or partially divided into semi-lozenge shaped areolae by a zig-zag intercalated nervure.

Interspace between mesosternal lobes transverse cuneiform, caudal margin of lobes oblique truncate; metasternal lobes broadly in contact.

¹² Rurrenabaque is at an elevation of 227 meters, its position approximately 14° 30' S., 67° 35' W.



Temnomastax beni new species. Male (*type*). Rurrenabaque, Bolivia. Fig. 1.—Lateral view of apex of abdomen. Fig. 7.—Dorsal view of same. Fig. 12.—Outline of fastigium as seen from dorsum. *T. hamus* new species. Male (*type*). Lassance, Minas Geraes, Brazil. Fig. 2.—As Fig. 1. Fig. 8.—As Fig. 7. *T. latens* new species. Male (*type*). Lassance, Minas Geraes, Brazil. Fig. 3.—As Fig. 1. Fig. 6.—Caudal aspect of same. Fig. 9.—As Fig. 7. Female (*allotype*). Same locality as male. Fig. 13.—As Fig. 1.* Fig. 14.—Outline of distal margin of ultimate sternite (subgenital plate) as seen from venter. *T. borellii* (Giglio-Tos). Male. Chapada, Matto Grosso, Brazil.

(Explanation continued at bottom of p. 17.)

Penultimate abdominal tergite with disto-dorsal margin broadly concavo-emarginate over base of ultimate tergite, with a rounded obtuse-angulation on each side between the emargination and the cercal base; antepenultimate tergite with the ventro-lateral angle of same produced into an acute projection which encompasses the ventral border of the lateral sections of the penultimate tergite; ultimate tergite (supra-anal plate) acute trigonal, reaching distad briefly beyond the cercal apices, and with its surface definitely sculptured into a more proximal trigonal concave area,¹³ which is delimited disto-laterad by marked converging straight and well elevated carinae, exterior to which the intra-marginal surface of the sternite is sulcate excavate, while distad of the carinae the surface of the apex is more elevated and smooth, this reaching to the lateral margins. Cerci as seen in profile, tapering in depth, proximal half virtually straight, distal half arcuately decurved, actual apex acutely unguiform, directed ventrad; as seen from the dorsum the shaft of the cercus is straight, in usual position subparallel to the lateral borders of the proximal portion of the ultimate tergite (supra-anal plate). Ultimate abdominal sternite (subgenital plate) compressed, produced meso-distad into a narrow, moderately elongate, fistuliform process, this medio-longitudinally carinulate ventrad, its apex narrowly rounded as seen from the dorsum, in profile subacute, the dorsal surface of the production definitely excavate in continuation of the anal chamber; dorso-lateral margins of the ultimate sternite thickened and cingulate, sigmoidally convergent to distal process as seen from dorsum, this margin and that of the process as seen in profile markedly sigmoid; chitinated portion of ultimate sternite shallow and laterad narrow in vertical depth, ventro-proximal membranous area large and separating the chitinous portions of the ultimate and penultimate sternites except briefly laterad: penultimate sternite relatively large and full, little compressed, its distal margin strongly arcuate bisemarginate with a nearly rectangulate median production.

Caudal femora reaching to apex of alar organs and definitely surpassing that of the abdomen; caudal tibiae with external spines ranging from 22 to 23 and internal from 22 to 25 in number: caudal metatarsus one and one-third times as long as the third tarsal article, disto-dorsal external tooth absent, proximal and median metatarsal pulvilli separated by a space less than half the length of either, median and distal ones contiguous.

Coloration.—General color of much of body and most of limbs olive-ocher, the abdomen passing distad through buckthorn brown to olive-citrine. Head with dorsum and most of genae vandyke brown, a pale obliquely descending postocular bar and entire face pale lemon yellow, eyes prout's

Fig. 4.—As Fig. 1. Fig. 10.—As Fig. 7. Female. Same locality as male. Fig. 16.—As Fig. 14. Fig. 18.—As Fig. 1.* *T. chiquitos* new species. Female (*type*). Provincia Sara, Bolivia. Fig. 17.—As Fig. 14. Fig. 19.—As Fig. 1.* *T. tigris* (Burr). Male. Corumbá, Matto Grosso, Brazil. Fig. 5.—As Fig. 1. Fig. 11.—As Fig. 7. Female. Same locality as male. Fig. 15.—As Fig. 14. (All figures greatly enlarged.)

* This is drawn from the dried specimen, and the ultimate sternite (subgenital plate) has not been pushed dorsad against the ovipositor valves.

¹³ Less concave in the paratype than in the type, and doubtless this has been influenced by shrinkage in drying.

brown, antennae whitish on the two proximal articles, passing rather abruptly to bone brown. Pronotum with dorsum and dorsal portion of lateral lobes heavily washed with vandyke brown, ventral portion of lateral lobes, obliquely following the ventral margin of the same, a duller lemon yellow. Tegmina with venation pencilled in bone brown, membrane washed with same. Pleura of the general color with intimation of a continuation of the dull lemon yellow bar of the lateral lobes of the pronotum. Abdomen having the distal extremity obscurely dark bilineate on each side on the tergite preceding the antepenultimate and on several other more proximal tergites, penultimate tergite largely brownish black, cerci with decurved tips darker than the bases. Caudal femora with the carinae, except the two ventral ones, pencilled with blackish, distal extremity of caudal femora and proximal portion of tibiae heavily washed with blackish brown; all tibiae and tarsi in part at least washed with glaucous green, spines and spurs in greater part or at least tipped with bone brown.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, <i>type</i>	19.7	2.60	15.9	13.3
♂, <i>paratype</i>	15.9 ¹⁴	2.44	15.4	13.0

In addition to the type we have before us a single paratype male bearing the same data as the type, and now in the collection of the Academy of Natural Sciences of Philadelphia. This specimen was immersed in a liquid preservative and subsequently dried, so that its color tones have been destroyed and its abdomen somewhat contracted. The structural features, however, are as in the type, and it also lacks the disto-dorsal tooth on the external face of the caudal metatarsus, thus showing absence of this in the type is not due to abnormality.

It is certain that *T. beni* is the most divergent member of the genus which we have examined. Whether *T. saurus* agrees with it or with the other members of the genus in the caudal metatarsal armament remains to be determined. In other features except alar details, however, *T. beni* is a typical *Temnomastax*, and alar development appears to be of secondary importance in this and a number of other genera of the Eumastacinae.

Temnomastax hamus¹⁵ new species

Text-figures 2, 8.

The male sex of the present species can at once be distinguished from that of all the other known members of genus by the strongly hooked and recurved cerci. The subrostrate ultimate sternite (subgenital plate) of the same sex is more produced than in *latens*, *borellii*, or *tigris*, but not as fistuliform as in *beni*. While *T. hamus* and *latens* occur at the same locality, the latter species is definitely a member of the species complex including

¹⁴ Abdomen somewhat shrivelled. Specimen dried from alcohol.

¹⁵ From *hamus*, a fish-hook, in allusion to the shape of the cercus of the male.

borellii and *tigris*, which is not true of the very distinctive *hamus*. The latter in cercal form carries the tendency noticed in *T. beni* to a far more pronounced degree, yet it differs from *beni*, and agrees with *hamus*, *borellii*, and *tigris*, in possessing a disto-dorsal external tooth on the caudal metatarsus.

The female sex of *hamus* is not known.

Type.—♂; Lassance, Minas Geraes, Brazil. November 9-19, 1919. (Cornell University Expedition; R. G. Harris.) [Academy of Natural Sciences of Philadelphia, Type no. 5625.]

Size medium; form slender, brachypterous; surface smooth.

* Head with occiput strongly arcuate ascendant cephalad to the fastigial apex, straight line distance from fastigial apex to caudal base of occiput subequal to dorsal length of pronotum: fastigium as seen from dorsum little produced, its length cephalad of cephalic borders of eyes not over one-fourth of the greatest fastigial width as seen in same aspect (as 3.5 to 14), the margin of the fastigium broadly arcuate transversely, slightly flattened mesad, not distinctly cingulate, in cross-section the dorsal surface of fastigium as seen in cephalic aspect is low arcuato-tectate; in profile the fastigium is not produced cephalad of the general eye outline (i.e. the broad median swell of the cephalic border of the same), although briefly surpassing the eyes at contact of same with fastigial lateral bases, apex of fastigium in profile blunt acute-angulate: head in cephalic view with greatest width across ventral part of genae very slightly less than that across eyes (as 46 to 50); frontal costa as in *T. beni* but the margins in inter-antennal section as not quite in contact; lateral (accessory) facial carinae as in *T. beni*; facial line in profile much as in *T. beni*, slightly more prominent between the antennae. Eyes slightly more prominent than in *T. beni*, in profile with outline ovate, slightly more flattened cephalad, width to depth as to 3.6 to 5.4. Antennae twelve-jointed, shorter and more robust than in *T. beni*, particularly the articles distad of the two proximal ones, the seventh distad especially stouter and stubbier than in *T. beni* and this area as a whole is proportionately more robust than in that species, this distal portion not as definitely depressed as in *beni*, apex similarly acute.

Pronotum in general characteristics as described for *T. beni*: cephalic margin of disk similar but more shallowly emarginate, caudal margin of disk weakly arcuate with a shallow median emargination; surface of metazona very faintly and incompletely impresso-punctate; lateral lobes less distinctly increasing in depth caudad than in *T. beni*, the caudal depth of the lobes to their total length being as 3.5 to 6.5 against 5 to 6.5 in *beni*, ventral margin sinuate as in *beni*, caudal margin vertical, straight, ventro-caudal angle rectangular, not at all produced.

Tegmina subcoriaceous opaque elliptical pads, very slightly longer than the dorsum of the pronotum, reaching to the distal third of the second abdominal tergite, greatest width contained one and seven-eighths times in greatest tegminal length (as 4 to 7.5), apex rather broadly rounded; venation marked, with major elements sharply defined and with but a limited amount of anastomosing veinlets between, leaving the areolets deeply etched

below the venation level. Wings falling but little short of the tegminal apices, apex rounded.¹⁶

Sternal features as described for *T. beni*.

Penultimate abdominal tergite with disto-dorsal margin broadly concave-emarginate over base of ultimate tergite, but slightly less sweeping so in lateral extent than in *T. beni*, with similar rounded obtuse-angulations on each side between the emargination and the cercal bases; antepenultimate tergite with its ventro-lateral angles similarly but more broadly and less acutely produced than in *T. beni*, similarly encompassing the ventral border of the lateral sections of the penultimate tergite: ultimate tergite (supra-anal plate) in its general form acute and surface sculpture much as in *beni*, the sharp apex briefly failing to reach as far distad as the bend of the cerci, surface sculpture with the converging carinulae defining the proximal area similarly but more sharply converging than in *beni*, the enclosed area markedly excavate, especially transversely along the proximal base, acute sublinguiform distal section appreciably excavate with a V-grooving distad to apex. Cerci with proximal half moderately tumid, but tapering, straight, at middle the cercus is sharply falciform and recurved ventromesad, the distal extremity thus directed cephalad beneath the ultimate tergite, this area appreciably compressed and deplanate, but tapering to the very acute apex, immediate dorsal base non-carinate but an intimation of this begins briefly proximad of the falcation. Ultimate abdominal sternite (subgenital plate) broad and relatively short, its greatest lateral length not over three-fifths the greatest width of the tergite, the disto-dorsal rostration very short, spout-like, particularly in profile, in the same view the apex of the process is acute-angulate, in dorsal view the generally concave convergent carinulate dorsal margins of the sternite are rectangulately fused at the apex; chitinized portion of ultimate sternite shallow but regularly broadening laterad, ventro-proximal membranous area proportionately as extensive as in *T. beni*: penultimate sternite broad and full, not at all compressed, its distal margin in full ventral view transverse truncate, in ventro-caudal aspect broadly concave.

Caudal femora surpassing the apex of the abdomen by a distance roughly subequal to the dorsal length of the pronotum and tegmina, slightly more slender in lateral aspect than in *T. beni*; caudal tibiae with external and internal spines in numbers ranging from 23 to 24;¹⁷ caudal metatarsus one and one-half times as long as the third tarsal article, disto-dorsal external tooth well developed, distal and median metatarsal pulvilli contiguous, separated from the smaller proximal one by a distance equal to the length of the median.

Coloration.—General pale base color on limbs, abdomen and most of venter ranging from very pale ochraceous-orange (type) to dull antimony yellow (paratype), pale color of head, pronotum and pleura ecru-drab (type) to vinaceous-drab (paratype), darker pattern clove brown to brownish black. Head with occiput as a whole dark, finely pale vermiculate, a

¹⁶ On account of the few individuals of this species available for study, we have not hazarded them by attempting to relax either to describe the alar venation.

¹⁷ In the single paratype seen the external spines range from 25 to 26, the internal from 24 to 25.

more solidly dark postocular bar, followed ventrad by a brief and incomplete whitish one, this failing to reach caudal margin of head, face dark with infra-antennal section thinly washed with pale lemon yellow; antennae with two proximal articles pale lemon yellow, the second edged distad with and the remainder quite solidly clove brown; eyes tawny-olive. Pronotum mottled with darker tones except for a pale longitudinal bordering bar ventrad on the lateral lobes, this irregularly broadening caudad. Tegmina clove brown with venation finely pencilled with very light ochraceous-salmon. Pleura weakly marked with dark. Abdomen with dorsum distad to and including third tergite preceding the antepenultimate one washed with clove brown, rather dilute except along the caudal border of the tergites where it is a denser transverse bar, the whole speckled with fine points of the pale base color; first and second tergites proximad of the antepenultimate pale dorsad with lateral dark areas, which are more or less clearly broken into longitudinal barring by pale areas; ultimate, penultimate and antepenultimate tergites solidly brownish black; cerci walnut brown to vandyke brown; ultimate sternite (subgenital plate) and entire venter of abdomen of pale base color; of sternum ceru-drab, paler mesad. Limbs of the pale base color, the caudal femoral carinae except the ventral pair and most all of the tibial ones pencilled with brownish black; caudal femora with apex, as well as the proximal extremity of the caudal tibiae, as well as one distinct and complete, and another more proximal, less definite and very incomplete annuli, clove brown to blackish brown, caudal tibiae weakly glaucous with an obscure sub-basal pale annulus, spines blackish brown.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, <i>type</i>	13.8 ¹⁸	2.44	2.93	13.6
♂, <i>paratype</i>	14.5 ¹⁸	2.28	3.09	12.7

In addition to the type we have seen a single paratype male bearing the same date as the type. This specimen, which is in the collection of Cornell University, shows no important differences from the type.

Temnomastax latens¹⁹ new species

Text-figures 3, 6, 9, 13, 14.

This species is a member of the species complex including *T. borellii*, *tigris* and *chiquitos*, agreeing in the general cercal type of the male (female of last mentioned all known). It differs, however, from all three in the longer tegmina and wings, which in the male reach the apex of the ultimate tergite (super-anal plate), and in details of the cercal form in the same sex, such as the lack of a proximo-dorsal lamella and the distinct and regular incurvature of the whole cercus. The female sex more nearly resembles that of *borellii* than of *tigris*, but can be distinguished from the former by the more rounded and less subtruncate outline of the fastigium as seen from

¹⁸ Apex of abdomen moderately recurved.

¹⁹ I. e., *concealed* or *hidden*, in allusion to the cercal features.

the dorsum, the more decidedly arcuate-elevated occiput and sharper fastigial angle as seen in profile, the longer and non-lobiform tegmina, the longer and more decidedly acute-produced caudo-lateral productions of the penultimate and antepenultimate abdominal tergites and the fewer and more robust ventro-external teeth on the ventral ovipositor valves. Comparison with the *T. chiquitos* is made under that species.

Type.—♂; Lassance, Minas Geraes, Brazil. November 9-19, 1919. (Cornell University Expedition; R. G. Harris.) [Academy of Natural Sciences of Philadelphia, Type no. 5627.]

Size medium, as in *T. hamus*; form slender, alate; surface smooth.

Head with its general proportions and contour as in *T. hamus*: fastigium with its emphasis, proportions and outline in dorsal view as in *hamus* except that in the latter view it is somewhat more broadly flattened mesad, the cross section of the fastigium as seen in cephalic aspect is more deplanate and not as arcuato-tectate as in *hamus*; in profile the fastigium is less acute and blunter in its production, in correlation with its general shape; head in cephalic view with greatest width across ventral part of genae somewhat less in proportion to that across eyes than in *T. hamus* (as 43 to 49, instead of 46 to 50); frontal costa and lateral (accessory) facial carinae as in *T. hamus*; facial line in profile ventrad of antennae very faintly concave between antennae, as in *hamus*. Eyes somewhat more prominent than in *T. hamus*, in profile slightly deeper in outline and evenly ovate, not flattened cephalad, width to depth as 3.8 to 5.4. Antennae twelve-jointed, somewhat more elongate and less robust than in *T. hamus*, articles of the median section more definitely moniliform, apex more sharply acute as in *hamus*.

Pronotum in general features as in *T. hamus*; cephalic margin of disk more definitely concavo-emarginate, caudal margin of disk slightly more arcuate than in *hamus* and virtually lacking a median emargination; median carinula of disk weak; lateral lobes not so strongly longitudinal as in *hamus*, greatest caudal depth to total length being 3.5 to 6, ventral margin distinctly sinuate, more so than in *hamus*, caudal margin straight, slightly oblique, ventro-caudal angle appreciably subacute produced.

Tegmina reaching as far distad as the cercal apices, subcoriaceous, subspatulately broadening in distal half, where greatest width (at distal seventh) is equal to nearly one-seventh of the tegminal length, apex evenly and relatively broadly rounded; costal margin, except for the weak lobation of the proximal two-fifths, virtually straight to the apical rounding, sutural margin nearly straight; venation regular and simple, few adventitious intercalated longitudinal nervures and these undulate, cross nervures few and irregular in direction. Wings reaching to tegminal apices.

Sternal features as in *T. beni* and *hamus*.

Penultimate abdominal tergite with arcuate emargination of distal margin as in *T. hamus* but broader, both actually and proportionately; antepenultimate tergite with the ventro-caudal production much narrower than in *T. hamus*, more sharply and acutely encompassing the ventro-lateral border of the penultimate tergite, similar in character to what is seen in

T. beni but more sharply arcuate caudad and less bent; ultimate tergite (supra-anal plate) acute trigonal, its converging lateral margins straight, not concave, apex not reaching distad of the cercal apices, surface sculpture simpler than in *hamus*, the whole more deplanate, the proximal decurvation more pronounced and more sharply defined, the lateral paralleling submarginal carination of proximal half acute and sublamellate, the surface of distal half weakly raised above that of proximal half, not sharply excavate as in *T. hamus*. Cerci, when seen from dorsum, regularly incurved, the tips but narrowly separated, seen in lateral elevation narrow, slightly and regularly narrowing distad, the apex subobliquely truncate with the ventral point subspiniform acute, the whole cerci compressed, more strongly so distad than proximad; seen in caudal aspect the cerci are seen to be weakly decurved in distal half. Ultimate abdominal sternite (subgenital plate) in profile suggesting that of *T. hamus* but in this view, and also in dorsal aspect, it is seen to be less spout-like, broader and more semi-elliptical in the shape of its regularly arcuate-convergent dorsal margins, which are not at all concave, in profile these margins are seen to be strongly arcuate proximad and thence straight oblique declivent to the apex, as seen from dorsum greatest length of sternite slightly less than greatest proximal-width of same; chitinous portion of ultimate sternite of similar shape to that of *T. hamus* but proportionately deeper laterad, ventro-proximal membranous area less extensive than in *T. hamus* but more so than in *beni*; penultimate sternite much as in *hamus* but distal margin appreciably concave in ventro-caudal aspect.

Caudal femora essentially as in *T. hamus*; caudal tibiae with 22 external and 23 internal spines; caudal metatarsus as in *T. hamus*, but with the distal and median pulvilli separated from the smaller proximal one by a distance slightly greater than the length of the median.

Allotype. — ♀; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the description of the male (type) in the following noteworthy features.

Size somewhat larger, alar organs reaching only to the middle of the abdomen.

Head and fastigium in almost all respects as in male; in cephalic view the greatest width across the eyes is but very slightly greater than that across the genae (as 52 to 51). Eyes as usual in female somewhat less prominent than in the male sex, but of similar outline and proportions. Antennae similar to but slightly shorter proportionately than in the male.

Pronotum essentially as in male, ventro-caudal angle of lateral lobes somewhat less acute produced.

Tegmina reaching only to the distal margin of the fifth abdominal tergite, in general shape as in male, similarly but less strongly subspatulate distad, the width there being approximately but one-eighth of the tegminal length, proximal lobation of costal margin covering the whole basal half, being actually, as well as proportionately, larger than in male. Wings reaching to tegminal apices.

Abdomen with ultimate tergite (supra-anal plate) acute trigonal, slightly surpassing the cercal apices, distal portion sublinguiform, proximal half of tergite deeply excavate, bounded laterad by carinate ridges extending from the base of the sublinguiform distal section to the base of the tergite,²⁰ the more lateral areas well marked off; penultimate tergite with distal margin dorsad broadly concave with a medio-longitudinal fission apparently dividing the tergite to its visible base, the borders flanking the fission very narrowly rounding to the general distal emargination; antepenultimate tergite with median fission continued to its base; caudo-lateral productions of the penultimate and antepenultimate tergites acutely developed, of the latter more sharply acute than in the other. Cerci elongate, tapering, styli-form. Infra-cercal plates large, reaching distad as far as the apex of the ultimate tergite, acute at apex, deeply excavate medio-longitudinally. Ovipositor valves moderately compressed, dentation of both dorsal margins of dorsal valves and of external margin of ventral valves robust, the teeth relatively large and few, ten in number on the dorso-external (excluding apical hook), eight on the dorso-internal and four on the ventro-external margins (similarly excluding apical hook). Ultimate sternite (subgenital plate) with distal margin weakly subrectangulately produced mesad, this flanked laterad by sigmoidally emarginate portions falling away to the strongly arcuate lateral bases of this margin of the sternite.

Limbs as in male, except that marginal spines of the caudal tibiae may number as many as 23 on the external and 25 on the internal margin.

Coloration.—Pale base color light ochraceous-buff, becoming pale mustard yellow on the femora; darker pattern bistre to brownish black. Head with occipital region and fastigium largely brownish black with a faint median line and accessory vermiculations of pale breaking its solidarity, of female much less solidly dark and the paler mottlings are strongly tawny; ventrad of the oblique postocular bar is a dark, similarly oblique, bar, while the lower genae and lower face are pale in the female, washed with slaty in the male. Antennae distad of the third article mummy brown, proximad light ochraceous-buff; eyes buckthorn brown to dresden brown, washed more (female) or less (male) dorsad with mummy brown. Pronotum largely dark in male, disk in same faintly russet, ventral border of lateral lobes indefinitely pale; in female the disk is as pale as buckthorn brown, the pale ventral portion of the lateral lobes broader, more solid and sharply defined from the quite dark continuation of the postocular bar which suffuses the dorsal portion of the lateral lobes. Tegmina almost entirely opaquely suffused with brownish black, becoming cinnamon-brown (male) to ochraceous-brown (female) in the anal field, venation of discoidal field weakly pencilled in whitish blue. Abdomen of male with the two tergites preceding the antepenultimate one solidly (except laterad on the more proximal one) amber yellow, sternites of apex of male abdomen similarly colored, remainder of apex mummy brown, more proximal portion of dorsum of male abdomen dark with indications of lateral pale lineations; abdomen of female decolored. Sterna of male dark, of female pale.²¹ Tibiae

²⁰ The exact trend and relative emphasis of these ridges cannot be determined accurately from the allotype, as the tergite is somewhat crumpled and folded by drying.

²¹ We feel the female allotype may have been immersed at some time in a liquid preservative.

pale glaucous, spines blackish, at least at tips. Caudal femora with their carinae except ventral pair largely pencilled with black, distal extremity (with proximal portion of tibiae) fuscous, as well as a moderately distinct and nearly complete pregenicular annulus, and another merely intimated more proximal in position.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, <i>type</i>	15.0	2.15	9.3	12.7
♀, <i>allotype</i>	20.5	2.55	8.9	15.0

We have seen only the type and allotype of this species which occurs at the same locality as the very different *T. hamus*.

Temnomastax chiquitos ²² new species

Text-figures 17, 19.

This species, of which the female sex alone is known, is related on one hand to *T. latens*, here described, and on the other to *T. borellii* (Giglio-Tos). From *latens* it can be distinguished at once by the far shorter alar organs, the tegmina being oval, and hardly longer than the pronotal disk, and with the wings completely non-functional as flight organs, and by the much more produced, acute sublanceolate ultimate sternite (subgenital plate), which is quite different in the shape of its caudal margin from that of *latens*. From *borellii*, which agrees in the general proportions of the alar organs, the characters given in the key will be ample for the separation of *chiquitos*, which latter differs further in other features such as the more broadly arcuate caudal margin of the pronotal disk, this being arcuato-truncate in *borellii*, and the more marked fastigial angle as seen in profile.

Type.—♀; Provincia Sara, Bolivia. February 5, 1922. (J. Steinbach.) [Hebard Collection, Type no. 1350.]

Size and general features essentially as in *T. latens*; tegmina ovate pads subequal in length to the pronotal disk.

Head with the arcuate elevation of the occiput as in *latens*; in profile the fascio-fastigial angle is seen to be slightly more produced than in *latens*, from the dorsum while the fastigium is equally broad, it is seen in transverse outline to be rounded broad obtuse-angulate mesad, instead of as a whole arcuate, as in *latens*; frontal costa and remainder of head as in *latens*, width across eyes as seen in cephalic aspect to that across broadest part of genae is as 50 to 55, instead of subequal as in the female of *latens*. Eyes in cephalic aspect somewhat less prominent than in *T. latens*, in basal outline slightly narrower than in the latter. Antennae as in *latens*.

Pronotum as in *latens*, but ventro-caudal angle of the lateral lobes less acute, nearer rectangulate.

Tegmina elongate elliptical, subequal in length to the pronotal disk, greatest width contained very slightly over twice in the tegminal length,

²² After the Chiquitos Indians of eastern Bolivia.

apex rounded; venation with the major longitudinal elements sharply indicated with a number of short cross-nervures of more irregular direction and disposition. Wings falling but slightly short of tegminal apices.

Abdomen with ultimate tergite (supra-anal plate) appreciably surpassing the cercal apices, general form as in *T. latens*; penultimate and antepenultimate tergites in general as in *latens*, the median fission of the penultimate in the type opened as an acute-angulate excision, possibly due to pressure, ventro-caudal productions of the lateral portions of both tergites similarly but less strongly rostrate, more narrowly rounded at their apices. Cerci similar to but slightly shorter than in the female of *T. latens*. Infra-cercal plates as in *latens*. Ovipositor valves essentially as in *latens*.²³ Ultimate sternite (subgenital plate) with the distal margin sharply acute-produced, the lateral parts of the margin faintly undulate, these briefly before the apex concavely emarginate, leaving the apex more acute than the converging margins.

Limbs as in *T. latens*.

Coloration.—Much as in *T. latens*. The head is more solidly brownish black dorsad, the pale postocular bar narrower and less definite, the genae largely dark mouse gray, the face below light ochraceous-buff, progressively washed with dresden brown toward the facio-clypeal suture, upper face to antennae and proximal and most of second antennal articles bright wax yellow, most of antennae including distad extremity of second article mummy brown; eyes fuscous, scumbled dorsad with brownish black flecks and points. Pronotum with disk almost uniformly dark with the post-ocular bar continuations of prout's brown. Tegmina mummy brown with venation lightly and incompletely pencilled in bluish white. Abdomen with dorsal surface largely washed more or less solidly with mummy brown, the second, third and fourth tergites preceding the antepenultimate paler, approaching dull isabella color, each narrowly darkened along distal margin, sides of more proximal tergites with indications of obscure sublongitudinal bars of paler tone, venter of abdomen, sterna and much of pleura dull light cadmium, passing on the more distal abdominal sternites into mars brown. Limbs colored as in *T. latens* except that the dark pregenicular annulus on the caudal femora is deeper, more solid and broader and the dark suffusion proximal on the caudal tibiae also deeper in tone and more extensive.

Length of body, 20 mm.; length of pronotum, 2.75; length of tegmen, 3; length of caudal femora, 14.7.

The type of this quite distinct species is unique.

Temnomastax borellii (Giglio-Tos)

Text-figures 4, 10, 16, 18; pl. I, fig. 1.

1897. *Masyntes borellii* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Univ. Torino, XII no. 302, p. 17. [♀; San Pedro, Paraguay.]

1911. *Masyntes chapadensis* Bruner, Ann. Carneg. Mus., VIII, pp. 6 and 8. [♂, ♀; Chapada and Corumbá, State of Matto Grosso, Brazil.]

The type of *borellii* is in the collection of the Zoological Museum of the University of Turin. The synonymy given above has already been estab-

²³ The exact number and relative size of the marginal ovipositor teeth varies on the paired margins.

lished by Candido Bolívar,²⁴ and we are in full agreement with his conclusions. A number of years ago, the senior author studied and reported²⁵ material of this species from Chapada, one of the original localities for *chapadensis*, and from the same lot as Bruner's representatives.

In order to narrow down *chapadensis* to a definite locality and type we are selecting Chapada as the type locality and indicating as the single type the measured male from that place in the collection of the Carnegie Museum at Pittsburgh. We have before us a pair of Chapada specimens, from the typical series taken by H. H. Smith, the male secured in October, the female in April, the former in the Academy series, the latter in the Hebard Collection.

The features used by Bruner to distinguish *chapadensis* from *borellii*, which latter he had not recognized from material, are covered by known individual variation in size, exact shape of caudal margin of pronotal disk and color tone.

The range of measurements in *borellii* presented by the pair before me, and past literature, is as follows (in millimeters):

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Bruner's meas. of type of <i>chapadensis</i>	14.0	2.0	2.7	10.5
♂, Chapada	19.2	2.7	4.72	14.2
♀, Giglio-Tos meas. of type of <i>borellii</i>	20.0	3.0	3.5	15.0
♀, Bruner's meas. of <i>chapadensis</i>	20.0	2.3	2.15	12.5
♀, Chapada	21.3	2.3	2.75	13.3

While the Chapada male before us is quite large, we know of an almost equal amount of size variation in individuals of *T. tigris* from a single limited district (i.e., Corumbá and Urucúm), and without further information can only assume environmental conditions may be responsible.

The range of *borellii* is known to extend from Paraguay (San Pedro) northward into the southern section of Matto Grosso, Brazil. It will probably be found to occur also in extreme northern Argentina.

***Temnomastax tigris* (Burr)**

Text-figures 5, 11, 15.

1869. *Masyntes tigris* Burr, Anales Soc. Españ. Hist. Nat., XXVIII, pp. 274, 276, pl. IX, fig. 11. [♂; Paraguay.]

1903. *Masyntes tigris* Burr, Genera Insectorum, Orthopt., Eumastacidae, p. 17, pl., fig. 7.

1911. *Masyntes brasiliensis* Bruner, Ann. Carneg. Mus., VIII, p. 6. [♂, ♀; Corumbá and Chapada, State of Matto Grosso, Brazil.]

²⁴ Bol. R. Soc. Españ. Hist. Nat., XVI, p. 198, (1916).

²⁵ Proc. Acad. Nat. Sci. Phila., 1904, p. 676, (1904).

BRAZIL: Corumbá, Matto Grosso; XII, 14-23, 1919: (Cornell Univ. Exped., R. G. Harris); 5 ♂; [Cornell Univ. and A.N.S.P.]. Urucúm, near Corumbá,²⁶ Matto Grosso; XII, 23-29, 1919; (Cornell Univ. Exped., R. G. Harris); 6 ♂, 6 ♀; [Cornell Univ. and A.N.S.P.].

We here select as single type of Bruner's *Masyntes brasiliensis* the single male of the pair on which the name was based, and similarly indicate Corumbá as the type locality for the same. The type of *tigris* is in the Bolívar Collection at Madrid.

The synonymy of *brasiliensis* was first suggested by the senior author in 1915,²⁷ and almost simultaneously established by Candido Bolívar,²⁸ the latter at the same time calling attention to the former's much earlier *tigris* records of both Corumbá and Chapada material from the same collection as that which formed the basis of Bruner's *brasiliensis*.

As to the variation in tegmenal length already noted by Rehn²⁹ and C. Bolívar,³⁰ and which was considered by Bruner as of diagnostic value in connection with *brasiliensis*, the material now before us gives further evidence of very definite variation in this respect, particularly in the male sex. Larger series may show some geographic correlation in the general size range. Representative measurements (in millimeters) of individuals from the series here reported or in the Philadelphia collections, are as follows:

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Corumbá, Brazil ³¹	20.0	2.60	7.66	13.1
♂, Corumbá, Brazil	16.3 ³²	2.77	8.31	14.5
♂, Urucúm, Corumbá, Brazil ...	17.2	2.85	8.63	15.0
♀, Urucúm, Corumbá, Brazil ...	28.0	3.26	7.98	16.0
♀, Urucúm, Corumbá, Brazil ...	26.0	2.93	7.57	16.5
♀, Embarcación, Salta, Argentina ³³	26.5	2.80	5.30	14.5

The series examined shows an appreciable amount of variation in the exact degree of arcuation, or even angulation, of the caudal margin of the pronotal disk, and also in whether a very faint median emargination of the same margin may or may not be present.

²⁶ Urucúm is but a score of miles from Corumbá, at the foot of the Massico do Urucúm. See Cherrie, in Naumburg, Bull. Amer. Mus. Nat. Hist., LX, p. 8, (1930).

²⁷ Proc. Acad. Nat. Sci. Phila., 1915, p. 280, (1915).

²⁸ Bol. R. Soc. Españ. Hist. Nat., XVI, p. 197, (1916).

²⁹ Proc. Acad. Nat. Sci. Phila., 1904, p. 676, (1904).

³⁰ Bol. R. Soc. Españ. Hist. Nat., XVI, p. 197, (1916).

³¹ In the collection of the Academy.

³² Apex of abdomen strongly flexed dorsad.

³³ In the collection of the Academy. Reported and measured by Rehn, Proc. Acad. Nat. Sci. Phila., 1915, p. 280, (1915).

This strikingly colored and very distinctive species is now known to range from as far north as Chapada, not far from Cuyabá, Matto Grosso, Brazil, south at least to Paraguay and westward to the Province of Salta (Embarcación), Argentina. The eastern extent of its range is quite unknown.

MASYNTES Karsch

1889. *Masyntes* Karsch, Entom. Nachrichten, XV, pp. 26, 31.

This entirely Antillean genus probably has as its nearest known relative the South American *Eumastacops* here described. Certain South American species, which are here placed in the new genus *Temnomastax*, have erroneously been referred to *Masyntes*, as is at once evident when the genotypic species of the latter is compared. These more austral forms all possess undivided, non-sulcate fastigia, quite unlike the type found in the present Cuban genus. In addition to the dichotomous contrasting of characters given in the present key to the genera, a diagnostic comparison of *Masyntes* and *Eumastacops* is given under the latter genus on a subsequent page.

While previously but a single species of *Masyntes* was known, supposedly ranging throughout the island of Cuba, material now before us shows definitely that at least six distinct, although closely related, forms occur in that island, these probably regionally limited, although available information is still too scanty to do more than suggest this interpretation. Three are known from certain areas of Oriente Province, the most eastern district, another which in some features is the most distinct, from a more montane section in the same province, a fifth is found in Camaguey and Matanzas provinces, and the sixth in the western portion of the island (Pinar del Rio Province). As to the occurrence of brachypterous and more fully alate individuals in the same species, reference is made to the discussion under generic remarks and also under *M. gundlachii*.

Generic characters.—Brachypterous or brevialate.³⁴ Head with occiput ascending; interocular vertex narrow, continuously sulcate or subsulcate with the fastigium, latter with subcariniform lateral margins, apex narrowly emarginate transversely, no transverse carina present, in profile cut off by a definite angulation from facial line, which is markedly declivent; frontal costa narrow, deeply sulcate dorsad, less distinctly so ventrad, lateral carinate margins compressed so as to be in contact between lateral ocelli; lateral facial carinae marked. Eyes moderately prominent. Antennae relatively short, slightly longer in male than in female, in the former slightly longer than, in the latter appreciably shorter than, the pronotal dorsum, slender at base, thence progressively slightly broader and usually subdeplinate, 13 articles, occasionally by fusion but 12 present. Pronotum elongate subsellate; cephalic margin of disk concave, caudal margin of same subtruncate to slightly arcuate; median carina weak or obsolete, lateral carinae

³⁴ The latter condition is unknown to us except from the literature. Whether the material so reported is actually representative of *Masyntes* remains to be confirmed.

developed as oblique cephalad descendent cicatiform rugae extending from the normal caudal position of lateral carinae at the caudal margin to the ventro-cephalic angle of the lateral lobes, principal transverse sulcus alone indicated, this obsolete mesad on the disk. Tegmina half to two-thirds as long as pronotal disk, hardly if at all surpassing distal margin of metanotum, ovate in outline or with apex subapicately developed; or two to three times as long as the pronotal disk.³⁵ Wings vestigial, completely hidden under tegmina. Prosternum with a transverse arcuate carination of variable emphasis and completion, less pronounced and straighter in males than in females, sometimes accompanied by and crossing a short medio-longitudinal carinula. Mesosternum-metasternum widening caudad, its lateral borders of varying carinulate emphasis, cephalic border of mesosternum cingulately sublunate; mesosternal interspace transverse, more strongly so in female than in male, broadly subeuneate, internal margins of lobes more strongly so in female than in male, broadly subeuneate, internal margins of lobes strongly oblique subtruncate; metasternal lobes broadly contiguous. Male cerci simple, styliiform, tapering, apices acute, incurved distad. Male ultimate tergite (supra-anal plate) trigonally scutellate, with distal extremity sublinguiformly differentiated. Male ultimate sternite (subgenital plate) scoop-shaped, compressed to a variable degree, ventral base of same with membranous section, dorsal margins as seen from dorsum converging angulately to apex. Female cerci relatively short, straight, styliiform, acutely tapering. Ultimate tergite (supra-anal plate) of female elongate trigonal, distal sublinguiform section evident as in male. Ultimate sternite (subgenital plate) of female with distal margin having a median trigonal production of varying length and exact shape, sections of margin laterad of production variously shaped. Ovipositor valves strongly compressed, dorsal pair as seen from dorsum slightly inbowed distad, dorso-external margins of same serrato-dentate, apices in profile moderately recurved; ventral ovipositor valves as seen from venter straighter, narrowing distad, in profile more falcate distad, ventro-external teeth stouter and sublamellate. Cephalic and median limbs relatively short, stouter in male than in female and occasionally weakly inflated, femora of males not definitely carinulate dorsad, of females appreciably so but varying in emphasis in different species. Caudal femora elongate, slender, surpassing apex of abdomen in male by at least the pronotal length, in the female reaching to approximately the abdominal apex, carinae not definitely serrulate,³⁶ medio-dorsal extremity of median carina and extremities of genicular arches and lobes brevispinose, paginal pattern distinct but not deeply etched; caudal tibiae with external marginal spines very short, internal ones biseriate in length, the longer at most nearly twice as long as the shorter; caudal metatarsi unarmed dorsad except for a very small external distal spinule, not more than twice as long as second article; arolium well developed, tarsal claws simple, subequal in length in the male, cephalic definitely the shorter in the female.

³⁵ This latter condition is unknown to us and is included on the basis of Bolivar's and Gundlach's comments. This type of development is discussed elsewhere in these generic comments.

³⁶ Certain apparent micro-serrulations are merely raised areas encircling the bases of scattered hairs.

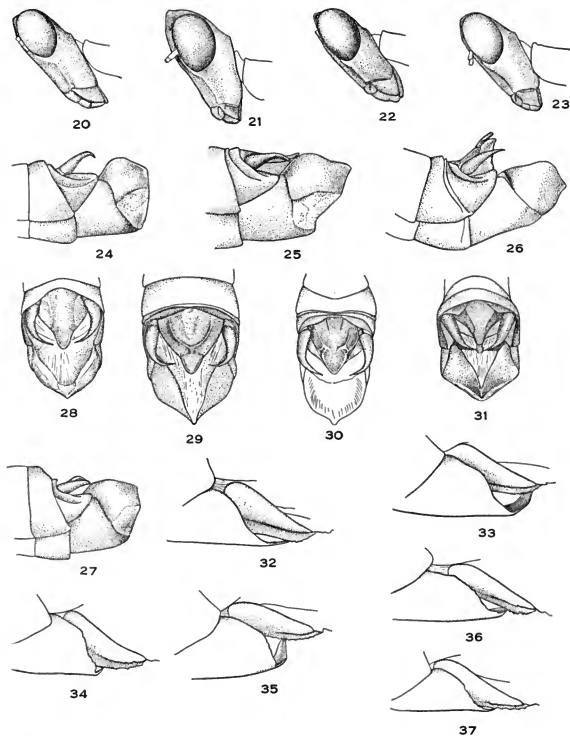
Genotype (by original designation).—*M. gundlachii* [*Mastax gundlachii*] (Scudder).

Key to Species

As we know the female sex alone of all six forms of *Masyntes*, and the males of but four, we have prepared keys to each sex separately. In using these keys reference should be made to the figures given for the respective species. When the males of *gundlachii* and *exitus* are definitely known it will be possible to construct a key combining the features of both sexes. The sections of the present key are purely artificial in their sequence of forms, which systematically in our opinion should be that in which they are treated in the following pages.

Females

1. Ultimate sternite (subgenital plate) with medio-caudal production elongate and attenuate, its acutely angled lateral margins evenly passing proximad into those of the sternite, the former margins immediately ventrad of internal margin of ventral ovipositor valves entire and lacking crenulations or a shoulder of any character. (Fastigio-facial angle subacute in profile.)2
- Ultimate sternite (subgenital plate) with medio-caudal production acute but shorter, its lateral margins immediately ventrad of internal margin of ventral ovipositor valves definitely separated from the lateral margins of the sternite proper by a crenulate section, a marginal shoulder or a pronounced situation or concavity.....3
2. Medio-caudal production of ultimate sternite (subgenital plate) more attenuate (see Text-figure 44), in profile the margin of same where production passes into the broader sternite less definitely concave. Serrato-dentations on dorso-external margins of dorsal ovipositor valves reaching to base of valves. Abbreviate tegmina acute ovate in outline, apices sharp but not definitely produced. (Camaguey and Matanzas Provinces.)*camaguei* new species
- Medio-caudal production of ultimate sternite (subgenital plate) less attenuate (see Text-figure 45), in profile the margin of same where production passes into the broader sternite more definitely concave. Serrato-dentations on dorso-external margins of dorsal ovipositor valves appreciably failing to reach bases of the valves. Abbreviate tegmina with attenuate apices submammillately produced. (Southern Oriente east of Santiago.)*gundlachii* new species
3. Medio-caudal production of ultimate-sternite (subgenital plate) distinctly cut off on each side from the lateral margins of the broader sternite itself by definite and sharp rectangulate marginal shoulders. (Abbreviate tegmina acute ovate, apices moderately acute but not produced.) (Pinar del Rio Province.)*poeyi* new species
- Medio-caudal production of ultimate sternite (subgenital plate) not cut off from lateral margins of the broader tergite itself by definite and sharp rectangulate marginal shoulders.....4



Masysles camaguei new species. Male (*type*). Camaguey, Cuba. Fig. 20.—Lateral view of head. Fig. 24.—Lateral view of apex of abdomen. Fig. 28.—Dorsal view of same. Female (*allotype*). Pan de Matanzas, Cuba. Fig. 32.—Lateral view of ultimate sternite (subgenital plate). *M. gundlachii* (Scudder). Guantánamo, Cuba. Fig. 33.—As Fig. 32. *M. macaca* new species. Male (*type*). Loma del Gato, Oriente, Cuba. Fig. 21.—As Fig. 20. Fig. 25.—As Fig. 24. Fig. 29.—As Fig. 28. Female (*allotype*). Sierra Maestra, Oriente, Cuba. Fig. 34.—As Fig. 32. *M. meddix* new species. Male (*type*). Coast below Pico Turquino, Oriente, Cuba. Fig. 22.—As Fig. 20. Fig. 26.—As Fig. 24.* Fig. 30.—As Fig. 28. Female (*allotype*). Same locality as male. Fig.

(Explanation continued at bottom of p. 35.)

4. Profile of fastigio-facial angle obtuse-angulate, hardly at all produced. Abbreviate tegmina with apices acute subproduced, not spatulate attenuate. Lateral margins of ultimate sternite (subgenital plate) adjacent to base of median production serrulato-crenulate. Eyes in profile with basal outline broader ovate. (Extreme eastern Oriente Province.) *exitus* new species
- Profile of fastigio-facial angle rectangulate to acute-angulate. Abbreviate tegmina with apices subspatulately attenuate. Lateral margins of ultimate sternite (subgenital plate) adjacent to base of median production sinuate or broadly convex, but not serrulato-crenulate. Eyes in profile with basal outline narrower ovate, with a more angulate tendency dorsad and ventrad. 5
5. Profile of fastigio-facial angle moderately acute; in dorsal view the fastigium is definitely produced cephalad of eyes. Lateral margins of ultimate-sternite (subgenital plate) separated from median production by a shallow emargination, laterad of which the sternite's margin is definitely sinuate. Serrato-dentations on dorso-external margin of dorsal ovipositor valves as a whole larger. (Sierra Maestra and Sierra del Cobre, Oriente Province.) *macaca* new species
- Profile of fastigio-facial angle rectangulate; in dorsal view the fastigium is less definitely produced cephalad of eyes. Lateral margins of ultimate sternite (subgenital plate) proximad of the median production broadly arcuate to basal portion of sternite. Serrato-dentations on dorso-external margin of dorsal ovipositor valves as a whole smaller. (Coast of western Oriente Province.) *meddix* new species

Males

1. Form as a whole more robust. Ultimate tergite (supra-anal plate) with a uniform semi-ovate carinula paralleling the proximal portions of the lateral margins and encircling the disk of the tergite, completely separating it from the linguiform distal section of the same. Ultimate sternite (subgenital plate) with angle of juncture of dorsal and distal outlines, as seen in profile, rectangulate. Cerci with median bend marked, sharp and subrectangulate. (Fastigio-facial angle rectangulate in profile. Limbs proportionately robust.) (Sierra Maestra and Sierra del Cobre, Oriente Province.) *macaca* new species

Form as a whole more slender. Ultimate tergite (supra-anal plate) with analogue of carinula described in alternative not semi-ovate, nor complete and not separating the disk of the tergite from the linguiform distal section of the same. Ultimate sternite (subgenital plate) with

35.—As Fig. 32. *M. poeyi* new species. Male (*type*). Taco Taco, Pinar del Rio, Cuba. Fig. 23.—As Fig. 20. Fig. 27.—As Fig. 24. Fig. 31.—As Fig. 28. Female (*allotype*). Pan de Guajabon, Pinar del Rio, Cuba. Fig. 36.—As Fig. 32. *M. exitus* new species. Female (*type*). Baracoa, Oriente, Cuba. Fig. 37.—As Fig. 32. (All figures greatly enlarged.)

*The ultimate tergite (supra-anal plate) is shown as pushed dorsad in the unique male (*type*).

- angle of juncture of dorsal and distal outlines, as seen in profile, obtuse-angulate to varying degrees. Cerci with median bend less decided, obtuse-angulate2
2. Profile of fastigio-facial angle roundly obtuse-angulate. Outline of dorsal margins of ultimate sternite (subgenital plate), as seen from dorsum, narrowly acute-angulate (narrowly V-shaped) distad. (Pinar del Rio Province.)*poeyi* new species
- Profile of fastigio-facial angle slightly obtuse-angulate to subacute. Outline of dorsal margins of ultimate sternite (subgenital plate), as seen from dorsum, broadly acute-angulate (i. e. broadly V-shaped) distad.3
3. Declivent facial line, as seen in profile, with its definite arcuation limited to dorsal three-fifths of same, ventrad straight oblique. Ultimate sternite (subgenital plate) with dorsal margin in profile more strongly elevated, proximal section of margin more subvertical. (Matanzas and Camaguey Provinces.)*camaguei* new species
- Declivent facial line, seen in profile, as a whole faintly but evenly arcuate. Ultimate sternite (subgenital plate) with dorsal margin in profile less strongly elevated, proximal section of margin more oblique dorso-cephalad. (Coast of western Oriente Province.)*meddix* new species

As yet we do not know the male sexes of *gundlachii* or *exitus*.

Distribution.—The genus *Masyntes* is at present known only from the island of Cuba, over which it is widely distributed, with probably areal localization of the various forms.

Probable history.—The genus *Masyntes* has a relatively isolated position with no really close relatives, although it has probably been derived from the same basic stock as several of the other genera of the Eumastaces. In a number of respects it is nearer the South American genus *Eumastacops*, here described, than any other, but even in that direction the differences are pronounced, and if the two are derivatives of the same stem of the phylum the divergence has been of long standing. Granting this affinity the ancestor of both has disappeared, or at least is not known to-day, and it may also have inhabited an intermediate land, where no relative of either genus now occurs, such as Central America.

Clearly *Masyntes* reached the Antilles from the mainland before the last Antillean land-bridge was submerged, or prior to the Upper Miocene or Lower Pliocene. If such a postulate of Central American common ancestry is well founded, *Eumastacops* entered South America either before the Middle Eocene or subsequent to the Upper Miocene, as the Panama marine portal was in existence during the intervening periods. The recent discovery of *Espagnola* and *Antillacris* in Hispaniola shows we yet have much to learn regarding this group in the Antilles. While no eumastacid is as yet

known from Jamaica, the same situation existed six years ago with *Hispaniola*, now known to have two endemic genera, and quite conceivably we may find relatives of *Masyntes* in either or both of these islands, in which case the past wanderings of *Masyntes*, or its ancestor, would be more evident.

Remarks.—Whether any of the species of *Masyntes* are dimorphic in wing length, as affirmed by Bolivar and Gundlach, remains to be verified. We have seen no material of this genus other than definitely brachypterous, and while alar length per se varies specifically in the group, we are unacquainted with any eumastacid species which has such definite intraspecific variation in alar length as that noted by Bolivar and Gundlach, except as a sexual feature, which latter is definitely not the case with *Masyntes*. The possibility exists that one or more of the four brachypterous species of *Masyntes* now known from the eastern part of Cuba, from which area came Gundlach's more alate individuals, may be dimorphic in wing length, but we feel this is hardly probable from our experience with the group as a whole. Our conviction is that the more truly alate individuals sent to Bolivar by Gundlach, and noted by both as having tegmina from 9 (♂) to 11 (♀) mm. long, were either representatives of a distinct species of *Masyntes* at present undescribed, or even possibly of a distinct and unrecognized genus.

*Masyntes camaguei*³⁷ new species

Text-figures 20, 24, 28, 32,
38, 44; pl. I, fig. 2.

This species of central and west-central Cuba is more nearly related to *M. gundlachii* than it is to the other species here described. The chief features of difference have already been given in the key to the forms of the genus, but the following comments are of additional value in the recognition of the species. The female sex has the most attenuate and sharply acute ultimate sternite (subgenital plate) of any form of the genus. The production of the fastigio-facial angle of the male, as seen in profile, is sharper than in *poeyi*, and nearer to what is found in *meddix*, although the curve of the facial line in profile is not the full arcuation seen in the latter. The shape of the male ultimate sternite (subgenital plate) is distinctive, with its marked elevation of the dorsal margins.

Type.—♂; Camaguey, Camaguey Province, Cuba. August 20, 1924. (J. Acuña.) [Academy of Natural Sciences of Philadelphia, Type no. 5591.]

Size medium; form more slender than in male of *M. macaca*.

Head as seen in cephalic aspect with greatest width across genae equal to four-fifths that across eyes (as 38 to 47); least interocular width, as seen from dorsum, but slightly more than one-seventh the width of the head across eyes (as 7 to 47), lateral margins subparallel, on fastigium converg-

³⁷ From the name of the aborigines of the Province of Camaguey.

ing cephalad, leaving a very narrow median cephalic emargination, caudad of which the fastigial disk is shallowly excavate, through the cephalic emargination continuous with the frontal costa; in profile the fastigio-facial angle is seen to be rounded subacute-angulate, fastigial plane slightly declivent toward the angle, facial line in profile gently arcuate in dorsal three-fifths, ventrad straight oblique; frontal costa with carinate lateral margins virtually in contact from very slightly ventrad of fastigio-facial angle to between the antennal bases, the margins lower and more remote yet quite definite thence to near the clypeal suture, the sulcus between distinct but not at all deep; eyes prominent, in dorso-ventral extent equal to one and three-fifth times the least infra-ocular depth of the genae, basal outline of eye as seen in profile broad ovate, width of same equal to infra-ocular depth of genae. Antennae slightly shorter than one and one-half times the length of the pronotal disk (as 48 to 70).

Pronotum with greatest width across lateral lobes cephalad contained one and one-third times in greatest median length of the pronotal disk, dorsal line of pronotum as seen in profile slightly concave; cephalic margin of disk with concavity well marked, caudal margin definitely arcuate, median carinae obsolete on prozona, low but evident on metazona, shallow impression of principal sulcus crossing disk mesad; oblique lateral carinae low but distinct, most evident on metazona, broad but less definite on prozona; lateral lobes of pronotum longitudinal, their greatest depth, as seen in profile, contained one and seven-eighths times in the greatest length of the lobes (as 25 to 47), cephalic margin rounding to ventro-caudal angle which in turn is very broadly arcuate, ventral margin with cephalic two-thirds slightly oblique declivent to the caudal third which is sinuate with the centro-caudal angle slightly acute-produced, caudal margin nearly straight vertical.

Tegmina but little more than half as long as the pronotal disk, very briefly surpassing the caudal margin of the metanotum, acute ovate in outline, the greatest width equal to half their length, apices narrowly rounded acute but hardly produced, sutural margin more strongly arcuate than costal, longitudinal venation regularly spaced and evident. Wings reaching to tegminal apices.

Abdomen medio-longitudinally carinulate dorsad, hardly at all compressed: ultimate tergite (supra-anal plate) with the paired longitudinal carinae definitely concave laterad, joining the lateral borders of the tergite at the base of the medio-distal linguiform process, which latter is not sharply defined proximad from the definitely excavate disk of the tergite, although the free border of the process is subeungulate and its apex rounded acute, lateral faces of tergite laterad of the paired longitudinal carinae strongly beveled and oblique declivent in surface trend; cerci with slender distal third inbent at somewhat less than a right angle, apex definitely aciculate, in profile the inbent portion is seen to be somewhat decurved; ultimate sternite (subgenital plate) moderately compressed, its dorsal margins as seen from dorsum converging at a moderately acute angle, in profile with its distal elevation from median point of the distal margin of the penultimate sternite definitely greater than the length in the same view of the ultimate sternite from its lateral base, distal outline in same view but faintly arcuate,

membranous base occupying slightly more than half of height, dorsal margin in profile subvertically ascending from immediate base, sharply rounding to the highest point and then subobliquely straight to its junction with distal outline.

Caudal femora surpassing apex of abdomen by nearly one and one-half times the greatest pronotal length, slender, greatest depth, which is at proximal fifth, contained six and one-half times in the femoral length; caudal tibiae with 21 to 22 external and 20³⁸ to 21 internal marginal spines.

Allotype. — ♀; Pan de Matanzas, Matanzas Province, Cuba. June 12, 1932. (S. C. Bruner, A. R. Otero and L. C. Scarramuzza.) [Academy of Natural Sciences of Philadelphia.]

Differing from the preceding description of the male sex in the following noteworthy features.

Size large (for the genus): form similar to but slightly more robust than in the male.

Head as seen in cephalic aspect with greatest width across genae subequal to that across eyes, least interocular width, as seen from dorsum, equal to one-fifth the width of the head across eyes (as 12 to 60), excavation of fastigial disk less definite than in male; in profile the fastigio-facial angle is narrowly rounded acute, definitely more pronounced than in the male sex, its fastigial plane not at all declivent toward the angle, facial line in profile with the slight arcuation of the dorsal three-fifths subsinuate; frontal costa briefly ventrad to the line of the paired ocelli with the lateral margins subcontiguous, thence to between the antennal bases the margins are slightly divergent, and ventrad of the median ocellus the costa is even less evident than in the male; eyes less prominent than in the male, in dorso-ventral extent equal to one and one-fifth times the infra-ocular depth of the genae, basal outline of eye in profile broad ovate, slightly acute ventrad, greatest width of outline equal to two-thirds of depth. Antennae not over six-sevenths as long as the pronotal dorsum.

Pronotum in general as in male sex, cephalic margin of disk subsinuate mesad and less evenly concave, caudal margin of same with median portion of arcuation subtruncate, median carina more evident than in male, continuing irregularly over prozona, surface of pronotal disk more rugulose and subeicatriciformly irregular brevi-carinulate; oblique lateral carinae more distinct than in male, uniformly indicated, much sharper and more clearly definite on the prozona than in the male; lateral lobes of pronotum as in male but surface, and particularly caudad on the metazona, is more rugulose.

Tegmina not exceeding half the pronotal length, falling slightly short of the caudal margin of the metanotum, shape as in male but slightly narrower, the greatest width contained two and one-fifth times in their length.

Ultimate abdominal tergite (supra-anal plate) more elongate trigonal than in male, its greatest proximal width (basal) contained one and one-third times in the tergite's length (as 26 to 35), sculpture with disk surface more deplanate, cut off from the linguiform distal process by a transverse subtruncate carinula, from the lateral ends of which paired similar carinulae extend subarcuately and divergingly to the base of the tergite, similar brief carinulae extend ventrocaudad from the juncture of the above mentioned

³⁸ As few as 19 in the paratypic male.

carinulae to the lateral margin of the tergite, portions of tergite laterad of the paired carinulae strongly deflexed, subvertical, discal surface mesad with a pair of subparallel low less sharply defined longitudinal carinulae, between which the surface is shallowly sulcate, distal linguiform process as in male but its juxta-carinular surface is transversely impressed, cutting off the more nearly plane surface of the bulk of the process; cerci damaged; serrato-dentations on dorso-external margin of dorsal ovipositor valves extending to the base of the valves, 12 to 13 in number, ventral valves with ventral surface of apex strongly concave, transverse cutting ridge at the base of the concavity marked, lateral marginal plate teeth to concavity two on each side, low, one low shearing tooth proximad of the transverse ridge, lateral plates of ventral ovipositor valves evenly narrowing distad, dorsal margin faintly sigmoid, very acute at apex; ultimate sternite (subgenital plate) with its distal margin acutely and evenly produced into a subaciculate median process, the apex of which lies between the bases of the ventral ovipositor valves, margins evenly converging distad without indentation, shoulder or crenulation of any kind, ventral surface of ultimate sternite evenly arcuate transversely.

Cephalic and median limbs much more slender than in male as is usual in genus, the femora in no way inflated. Caudal femora reaching approximately to the apices of the ovipositor valves, greatest depth, which is at proximal fifth, contained seven and one-third times in the femoral length; caudal tibiae with 23 external and 19 to 20 internal marginal spines.

Coloration.—Male with general body tone tawny-olive with a wash of mikado brown on the abdomen, the limbs, face, lateral lobes of pronotum, venter and pleura olive-ocher, apices of caudal femora infusate, caudal tibiae pale isabelline washed distad with scarlet-red, as is less definitely true of the caudal metatarsi and distal extremities of the cephalic and median tibiae, tibial spines black tipped; antennae of base color proximad becoming pale scarlet-red; eyes clay color; sides of ultimate sternite (subgenital plate) and infra-cercal parts of penultimate and antepenultimate tergites washed with fuscous; cerci distad washed with pale scarlet-red. Female almost uniform dresden brown, face pinkish cinnamon, antennae cinnamon-buff, eyes clay color to snuff brown, lateral lobes of pronotum ventrad of oblique lateral carinae clouded with blackish fuscous, caudal tibiae with but the faintest trace of scarlet-red distad, caudal femora in proximal half slightly paler than the general tone.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Camaguey, <i>type</i>	16.4	2.05	1.10	11.9
♂, Camaguey, <i>paratype</i>	15.5	2.60	1.54	11.9
♀, Pan de Matanzas, <i>allotype</i> ..	31.6	3.60	1.95	18.7

In addition to the type and allotype we have before us a paratypic male bearing the same data as the type.

In the shape of the ultimate sternite (subgenital plate) this species stands quite definitely at one end of the series of forms of *Masyntes*, while the male in genitalic characteristics is similarly well marked off.

It remains to be seen how broadly *camaguei* is distributed over central, east central and west central Cuba. The two localities known for it are well separated, over 250 miles of air-line distance intervening between Camaguey and Pan de Matanzas, which latter is a short distance west of the city of Matanzas. A careful evaluation of the features of the two sexes, however, has convinced us of the specific identity of the same.

Masyntes gundlachii (Scudder)

Text-figures 33, 39, 45.

1875. *Mastax gundlachii* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 266. [♀ (but not ♂); "Cuba".]

1889. *Masyntes gundlachii* Karsch, Entom. Nachrichten, XV, p. 31. (Combination.)

CUBA: Guantánamo, Oriente; V, 22, 1912; (C. T. Ramsden); 1 ♀; [A.N.S.P.]. San Carlos Estate, Guantánamo, Oriente; X, 4-8, 1913; (Lutz); 1 ♀; [A.M.N.H.].

Original series.—Scudder based this species on three specimens, two females and one broken male, all of which are now in the collection of the Museum of Comparative Zoology, where they have recently been studied by us and compared with the material of the genus here reported. All three specimens bear the same labelling, which shows their source originally to have been the Gundlach Collection number 58, and in addition they are labelled in Scudder's handwriting "*Mastax gundlachii* Scudd." One of the two females has been selected by us as the single type, and so designated by an extra label, and to this specimen the museum type record (8732) should be restricted. This single type lacks the right median tarsus, while the paratype female has one caudal limb detached and lacking the proximal two-thirds of the femur, the antennae, right cephalic limb and distal portion of left cephalic tarsus also being missing. The male of the *gundlachii* original series, as noted by Scudder is broken, being minus the head, most of the pronotum, right cephalic and right caudal limbs. All three of these original specimens have the tegmina rudimentary, in none quite equalling half the pronotal length.

We are now able to say definitely that the male originally assigned to *gundlachii* by Scudder, represents a species distinct from that represented by the selected type and the paratype female. This conclusion is reached from the evidence of the apex of the abdomen, the head and most of the pronotum, with their important characters, of this specimen not being available, as they may not have been to Scudder in 1875. Thus the original male individual we refer to the species here described as *M. poeyi* from western Cuba, while *gundlachii*, on the basis of the original features, is as far as known restricted to parts of Oriente Province.

Gundlach's specimens were not individually marked for locality, and we know that by 1859 his collecting travels had taken him over the greater part of Cuba,³⁹ so that in the series of *gundlachii* sent by him to Scudder and in

³⁹ See Ramsden, Entom. News, XXVI, pp. 241-260, (1915): Mem. Soc. Cubana Hist. Nat. "Felipe Poey", III, pp. 146-168, (1918).

those retained in Cuba, there is every reason to believe he had included material from several parts of the island. Gundlach's comments⁴⁰ on what he considered variation in alar development in individuals supposed by him to represent solely *gundlachii*, show that he had taken *Masyntes* in both the eastern and western parts of Cuba, all of which material he considered to represent the single species *gundlachii*.

Apparently the type and the accompanying paratype female examined by Scudder came from the Guantánamo region of Oriente Province, to which district, as far as we know, *gundlachii* is restricted. Gundlach, according to Ramsden,³⁹ worked at Caimanera on Guantánamo Bay, and about Yateras, east of Guantánamo, in 1858 and 1859, and from what we know of the distribution of *gundlachii* it is safe to consider the Guantánamo district the original locality.

Present material.—The Guantánamo and San Carlos females here recorded fully agree in all respects with Scudder's original females except they are slightly smaller. This size difference may be either individual or environmental, both of which conditions we know occur within some species of other eumastacid genera. Below we are giving measurements of present material and the typical females.

As to the male sex of true *gundlachii*, which is as yet unknown to us, we can only assume that it may be found to possess characters approximating those of that sex of *M. camaguei*, to which on the basis of the female sex *gundlachii* is most intimately related. As we know the female sex of *poeyi*, to which species we are certain, from comparisons, that the male originally referred to *gundlachii* by Scudder belongs, we are warranted in assuming the unknown male of the latter probably differs as appreciably from *poeyi* as the females of the two do from one another.

Reported Alar Dimorphism.—Ignacio Bolívar, in his study of Gundlach's collection of Cuban Orthoptera,⁴¹ which, however, contained none of the original *Masyntes* material studied by Scudder, states that *gundlachii* was there represented by material having two types of tegminal development, i. e., one with these appendages very abbreviate, as in the type series and in all the individuals, not only of this species but of the genus, which we have so far seen, the other with the same organs from 9 (♂) to 11 (♀) mm. long, and bearing near the extremity a weakly evident whitish spot. Gundlach later⁴² elaborated on Bolívar's comment and parts of his remarks are sufficiently important to warrant quotation, particularly as the present

⁴⁰ Contr. Entom. Cubana, II, pte. 4, pp. 335-336, (1891).

⁴¹ Bull. Soc. Zool. France, I, p. 141, (1888).

⁴² Contrib. Entom. Cubana, II, pte. 4, pp. 335-337, (1891).

material does not support his statement as to regional association of macropterous individuals. The more important of his observations are as follows: "En la parte occidental he encontrado solamente individuos con los elitros rudimentarios y en la parte oriental v. g. Sierra Maestra y Yateras con elitros y alas de 9 milímetros en el macho y de 11 en la hembra. Los elitros tienen cercana á la extremidad una macha blancusca poco visible."

It is possible this species is dimorphic in tegminal length, and the more fully alate type is rarer and more infrequently seen than the brachypterous one, but we feel quite definitely the two supposed phases probably represent distinct species of the genus, or possibly even distinct genera. Gundlach's own comments as to the different color patterns of the two types, both of which he carefully described, lend support to our conclusion. It is certain, however, from the evidence of present material, that extremely brachypterous individuals of *gundlachii*, inseparable from the type females, occur in eastern Cuba, despite Gundlach's comments.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♀, <i>type</i> (Scudder Coll.)	25.5	3.58	1.30	17.0
♀, <i>paratype</i> (Scudder Coll.)	26.0	3.58	1.46	16.7
♀, Guantánamo	22.6	2.93	2.11	15.4
♀, San Carlos Estate	22.0 ⁴³	2.93	1.95	14.6

Distribution.—Whether true *gundlachii* is found throughout Cuba, as believed by Gundlach, or is limited to probably localized portions of Oriente Province, as we feel to be true, can be determined only as additional information becomes available. Gundlach's material from western Cuba very probably represented other species of the genus, such as *M. poeyi* concerning which the evidence is conclusive. Certainly all the material with exact localities seen by us which is clearly referable to *gundlachii*, is from the vicinity of Guantánamo, Oriente Province.

Masyntes macaca ⁴⁴ new species

Text-figures 21, 25, 29, 34,
40, 46; pl. 1, fig. 3.

This species, which is known to us only from the higher areas of Oriente Province, can at once be distinguished from the other members of the genus by its proportionately more robust form in the male, and the other details given in the key to the species. It is, as a whole, as close to *M. meddix*, here described, as to any other member of the genus, particularly on the basis of the characters of the female sex, but the male shows a number of genitalic features which are definitely diagnostic.

⁴³ Less than true length, as head is pushed dorso-caudad.

⁴⁴ After the tribe of aborigines which inhabited the Sierra Maestra region.

Type.—♂; ⁴⁵ Loma del Gato, Sierra del Cobre, Oriente Province, Cuba. Elevation, 2600-3325 feet. October 1-2, 1935. (J. Acuña and S. C. Bruner.) [Academy of Natural Sciences of Philadelphia, Type no. 5590.]

Size somewhat larger than in *M. camaguei* and appreciably greater than in *meddix*; form slightly more robust than in relatives.

Head in cephalic aspect faintly broader than in *camaguei*, but relative width across genae and eyes as in that species; least interocular space, as seen from dorsum, slightly broader than one-sixth the width of the head across the eyes (as 9 to 51), outline of same area and fastigial shape, margins and excavation, as seen from dorsum, as in *M. camaguei*, in profile the fastigio-facial angle is rectangulate with the ventral (i. e. facial) section of angle subarcuate, the fastigial plane not at all declivent to the angle, facial line in profile moderately arcuate dorsad, ventrad subsinuately oblique; frontal costa with distinctly and sublamellately carinate lateral margins evenly subcontiguous from fastigium to the median ocellus, ventrad of which the costa is essentially as in *camaguei*; eyes as prominent as in *camaguei*, in dorso-ventral extent equal to one and one-half times the least infra-ocular depth of the genae, basal outline of eye as seen in profile as in *camaguei*, with width of same subequal to least infracoxal depth of genae. Antennae damaged.

Pronotum in general much as in *M. camaguei*, proportions, profile and shape of cephalic margin of disk as in same, caudal margin of disk transversely truncate with a small and shallow median obtuse-angulate emargination; median carina as in *camaguei*, impression of principal transverse sulcus crossing disk very slightly caudad of middle; oblique lateral carinae distinct and continuously evident except for the pronounced severance by the principal sulcus, broad and not sharply elevated, trend as in *camaguei*; lateral lobes of pronotum as in *camaguei* except that ventro-caudal angle is subrectangulate and hardly at all produced.

Tegmina, evidencing the specimen to be in the instar preceding maturity, hardly surpassing the distal margin of the mesonotum, extrorsal in position, apex rounded acute. Wings mere rudiments, shorter than tegmina, fully exposed.

Abdomen not at all compressed; ultimate sternite (subgenital plate) broad trigonal, its median length subequal to its proximal width, lateral margins proximad of the medio-distal linguiform process distinctly convergent distad, slightly arcuate, surface carinae of the disk arcuately convergent and joining distad, thus forming an evenly bowed, almost semi-circular raised carinate figure, connected distad with the base of the linguiform process by a very brief but distinct medio-longitudinal carina, surface of the enclosed area with a shallow medio-longitudinal impression, narrowing distad and subcarinately bordered laterad, lateral bordering portions of tergite concavely excavate, distal linguiform process much as in *camaguei*; cerci with distal two-fifths sharply inbent, virtually at a right angle to the axis of the more inflated proximal section, the distal two-fifths arcuate aecilate, this portion in profile seen to be definitely decurved; ultimate sternite (subgenital plate) with dorsal margins as seen from dorsum more

⁴⁵This specimen is in the instar preceding maturity. See under "tegmina" in description.

sharply acute-angulate convergent distad than in *camaguei*, in profile with its distal elevation from median point of the penultimate sternite subequal to the length in the same view of the ultimate sternite from its lateral base, distal outline in same view straight, membranous base occupying slightly more than half of height, dorsal margin in profile with its proximal arcuation similar to but definitely lower than in *camaguei*, the margin distad more rectangulate with the distal outline, the immediate angle briefly oblique subtruncate.

Cephalic and median femora appreciably, and the respective tibiae slightly, more robust than in the male of *M. camaguei*; caudal femora relatively shorter than in *camaguei*, exceeding the abdominal apex by but little more than the pronotal length, somewhat more robust than in *camaguei*, greatest depth contained six and one-third times in femoral length; caudal tibiae with 23 to 25 external and 20 to 21 internal marginal spines.

Allotype.—♀; Sierra Maestra, Oriente Province, Cuba. Elevation, 600-900 meters. July 10-20, 1922. (C. H. Ballou and C. F. Bruner.) [Academy of Natural Sciences of Philadelphia.]

Differing from the description of the female sex of *M. camaguei* and that of the male of the present species in the following noteworthy respects.

Size faintly smaller than that of *camaguei* (female); form hardly more robust than in that species.

Head as seen in cephalic aspect with greatest width across genae subequal to that across eyes, least interocular width, as seen from dorsum, contained four and one-half times in the width of the head across eyes (as 13 to 59), excavation of fastigium and shape of same essentially as in female of *camaguei*; in profile the fastigio-facial angle is narrowly rounded acute as in the female of *camaguei*, the facial profile much as in the female of the latter; frontal costa as in female of *camaguei* but slightly narrower ventrad of the paired ocelli than in that species; eyes slightly more prominent laterad than in female of *camaguei*, in dorso-ventral extent equal to one and one-seventh the infra-ocular depth of the genae, basal outline of eye in profile broad ovate, faintly acute ventrad, greatest width of outline equal to three-fifths of depth. Antennae damaged.

Pronotum in major characteristics as in female of *camaguei* except that the cephalic margin of the disk is evenly but quite shallowly concave;⁴⁶ oblique lateral carinae very distinct, more evident, straighter and sharply sculptured than in the female of *camaguei*, interrupted solely by the deeply incised lateral sections of the principal sulcus; lateral lobes of pronotum as in female of *camaguei*.

Tegmina nearly equal to three-fifths the length of the pronotal disk, their apices reaching virtually to the middle of the proximal abdominal tergite, in shape narrowing from base to distal fourth, the apex distinctly and roundly subspatulate produced. Wings falling but slightly short of tegminal apices.

Ultimate abdominal tergite (supra-anal plate) twisted and shrivelled in drying so that proportions cannot be exactly determined and sculpture is exaggerated, however, these features on comparison appear to be essentially

⁴⁶ The caudal margin of the disk is damaged by the pin in the single female of *macaca*, but enough remains to make us feel it has the same outline as in *camaguei*.

as in the female of *camaguei*; cerci elongate tapering styiform, apex blunt acute, reaching as far distad as the attenuate ventro-caudal point of the penultimate tergite; serrato-dentations on dorso-external margin of dorsal ovipositor valves briefly failing to reach the base of the valves, ten in number, ventral valves slightly more slender than in *camaguei*, the ventral surface of their apices as strongly concave as in that species, transverse cutting ridge even stronger and more complete than in *camaguei*, lateral marginal plate teeth to concavity two in number but with distal one larger and stouter than in *camaguei*, ventral aspect of remainder of ventral ovipositor valves as in *camaguei*, lateral plates of ventral valves more elongate, more attenuate and acute distad than in *camaguei*; ultimate sternite (subgenital plate) with its distal margin but bluntly and sinuately produced mesad, except for the very brief median acute point the converging margins approach one another at a very obtuse angle and each is bisinuate, the more lateral undulation larger and broader, the more mesal shorter, sharper and more directly flanking the base of the median brief process, ventral surface of ultimate sternite evenly arcuate transversely.

Limbs as in female of *camaguei*; caudal tibiae with 25 external and 19 to 20 internal marginal spines.

Coloration.—Male with general body color as seen from dorsum olive-brown, distad on the abdomen washed in places with vinaceous-tawny, limbs in large part, sterna, pleura and part of the infra-carinal portion of the lateral lobes of the pronotum olive-ocher, venter of abdomen tawny-olive; eyes olive speckled with blackish fuscous; oblique lateral pronotal carinae washed with cinnamon, bordered broadly on ventral side with mummy brown; distal portion of ultimate sternite broadly marked laterad with mummy brown, as is also the ultimate tergite and the lateral faces of the penultimate and antepenultimate tergites, genicular extremity of the caudal femora and the proximal portion of the caudal tibiae suffused with fuscous; distal fourth of the caudal tibiae and the two proximal tarsal articles washed with dull carmine, distal half or more of the cephalic and median tibiae similarly tinted, remainder of tarsi dull elm green, tibial spines largely blackish. Female largely mummy brown, paling on the dorsum of the pronotum and most of the head to bister or snuff brown; eyes hazel, marked with fuscous; oblique lateral carinae of the pronotum conspicuously light ochraceous-buff, sharply separating the two tones of the pronotal coloration; tegmina buckthorn brown, marked unevenly with prout's brown; tibiae with very weak suggestions of the red distal areas seen in the male.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Loma del Gato, <i>type</i>	17.2	2.60	— ⁴⁷	13.3
♀, Sierra Maestra, <i>allotype</i>	27.7	3.58	2.11	16.6

We have seen only the male type and the female allotype of this species.

⁴⁷ See comment in description of male.

Masyntes meddix ⁴⁸ new species

Text-figures 22, 26, 30, 35, 41, 47.

This form of the coastal strip at the foot of the Sierra Maestra range west of Santiago Bay, has in the female close resemblance to the same sex of *macaca*, of the higher parts of the Sierra Maestra and related mountains, but the profile of the fastigio-facial angle instead of being acute is definitely rectangulate, while the abdominal appendages of that sex show a number of distinctive differences mentioned in the key to the species of the genus. The male of *meddix* is more slender than that of *macaca*, and both the ultimate tergite (supra-anal plate) and the ultimate sternite (subgenital plate) show marked differential features, which also are given in the key.

Type.—♂; Coast below Pico Turquino, Sierra Maestra, Oriente Province, Cuba. June 26 to 30, 1936. (P. J. Darlington, Jr.) [Museum of Comparative Zoology.]

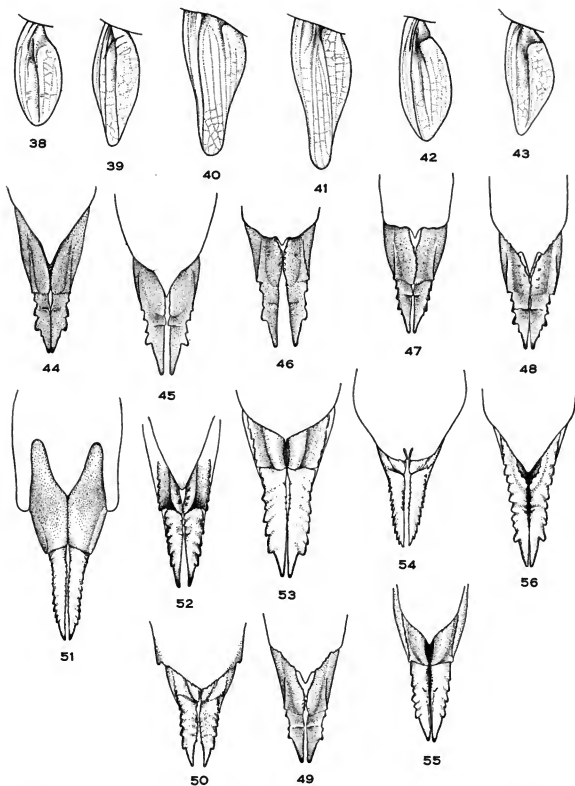
Form distinctly smaller than in male of *M. macara*, slightly smaller than that of *M. camaguei*; form as slender as in *camaguei*, somewhat more compressed than in *macaca*.

Head in cephalic aspect with the relative width across eyes and genae as in *camaguei*; least interocular width, as seen from dorsum, distinctly less than one-seventh the width of the head across the eyes (as 6 to 46), the excavation and cephalic emargination of the fastigium as in *camaguei* and *macaca*, but lateral bounding carinae subparallel for a great part of their length, being sharply arcuate mesad only at the immediate cephalic extremity, where they abruptly pass into the lateral carinae of the frontal costa, in profile the fastigio-facial angle is very slightly obtuse, the fastigial plane very faintly declivent to the angle, the oblique face with its outline rather weakly but definitely arcuate as a whole; frontal costa as in *M. macaca* except that immediately dorsad the carinate margins are definitely but briefly separated; eyes in prominence and basal outline as in *M. camaguei* but of slightly greater vertical extent in basal outline, this being nearly one and three-quarters times that of the infra-ocular portion of the genae (as 38 to 22), while the width of the eye outline is one and one-third times the infra-ocular genal depth (as 25 to 22). Antennae damaged.

Pronotum in general as in male of *M. camaguei*, concavity of cephalic margin of disk more strongly marked, caudal margin of same very faintly obtuse-angulate mesad, transverse sulcus and median carina as in *camaguei*, oblique lateral carinae as in same but even more evident and regularly converging caudad on metazona as seen from dorsum; lateral lobes as in *camaguei*.

Tegmina in length equal to slightly more than three-fifths that of the pronotal disk, definitely surpassing the caudal margin of the metanotum and reaching to the middle of the proximal abdominal tergite, lanceolate-ovate in outline, greatest width equal to half the length, apex narrowly rounded acute and but moderately produced, sutural margin faintly sigmoid emarginate in distal half, longitudinal venation regular. Wings apparently falling somewhat short of reaching the tegminal apices.

⁴⁸ I. e. an *Oscan magistrate*, in allusion to the characteristic pose of many sitting eumastacids.



Masyntes camaguei new species. Female (*allotype*). Pan de Matanzas, Cuba. Fig. 38.—Tegmen. Fig. 44.—Ventral view of margin of ultimate sternite (subgenital plate) and ventral ovipositor valves. *M. gundlachii* (Scudder). Female. Guantánamo, Cuba. Fig. 39.—Tegmen. Fig. 45.—As Fig. 44. *M. macaca* new species. Female (*allotype*). Sierra Maestra, Oriente, Cuba. Fig. 40.—Tegmen. Fig. 46.—As Fig. 44.

(Explanation continued at bottom of p. 47.)

Ultimate abdominal tergite (supra-anal plate) broad trigonal as in *macaca*, its sculpture suggesting a condition between that seen in *camaguei* and *macaca*, the paired carinae being nearly straight distad to within a short distance of the medio-distal linguiform production, where they sharply approach one another, then at a right angle run parallel and very close to one another to the base of the production, the lateral bevels of the tergite suggesting these of *macaca*, delimited distad by a short cross carina running from the respective one of median pair to the lateral margin, medio-distal linguiform process as in *camaguei* but with the surface less excavate; cerci with bend close to distal third, the angle of same obtuse and the distal section is nearly straight oblique, as aciculate as in *camaguei*, in profile hardly at all decurved; ultimate sternite (subgenital plate) little compressed, with dorsal margins as seen from dorsum broadly yet acute angulate convergent, these weakly sinuate, in profile with distal elevation from median point of the distal margin of the penultimate sternite hardly more than half the length in the same view of the ultimate sternite from its lateral base, distal outline in same view very faintly sigmoid, membranous area narrow, little evident,⁴⁹ dorsal margin in profile obtuse-angulate in the middle, the angle itself narrowly rounded and the proximal and distal sections of the outline each straight, the distal meeting the distal outline almost at a right angle.

Cephalic and median femora no more robust than in *M. camaguei*, slightly shorter than in latter; caudal femora surpassing apex of abdomen by no more than the length of the pronotal disk, as slender as in *camaguei* and quite similar in details; caudal tibiae with 23 to 27 external and 20 internal spines.

Allotype.—♀; same data as type. [Museum of Comparative Zoology.]

Differing from the description of the male and that of the female of *macaca* in the following noteworthy features.

Size essentially as in female of *macaca*.

M. meddix new species. Female (*allotype*). Coast below Pico Turquino, Oriente, Cuba. Fig. 41.—Tegmen. Fig. 47.—As Fig. 44. *M. poeyi* new species. Female (*allotype*). Pan de Guajaibon, Pinar del Rio, Cuba. Fig. 42.—Tegmen. Fig. 48.—As Fig. 44. *M. exilis* new species. Female (*type*). Baracoa, Oriente, Cuba. Fig. 43.—Tegmen. Fig. 49.—As Fig. 44.

Eumastacops unca new species. Female (*allotype*). Itacoatiara, Amazonas, Brazil. Fig. 50.—As Fig. 44. *E. trifida* new species. Female (*type*). Potaro Landing, British Guiana. Fig. 51.—As Fig. 44. *E. nemorivaga* new species. Female (*allotype*). Teffe, Amazonas, Brazil. Fig. 52.—As Fig. 44. *E. militaris* (Gerstaecker). Female (*allotype*). Fonteboa, Amazonas, Brazil. Fig. 53.—As Fig. 44. *E. plebeja* (Gerstaecker). ♀ (*type*). Fonteboa, Amazonas, Brazil. Fig. 54.—As Fig. 44. *E. parishi* new species. Female (*type*). Kartabo, British Guiana. Fig. 55.—As Fig. 44. *E. caligo* new species. Female (*allotype*). Rio Autaz, Amazonas, Brazil. Fig. 56.—As Fig. 44. (All figures greatly enlarged.)

⁴⁹ How much possible downflexing of the ultimate sternite may have to do with the limited extent of the membranous area cannot accurately be determined. The sternite, however, shows no evidence at its distal base of protruding membrane, as one might expect if an extensive membranous area was clamped between the two sternites.

Head with width across eyes subequal to that across genae as viewed in cephalic aspect; least interocular width, as seen from dorsum, equal to one-sixth that across eyes (as 10 to 60), lateral margins of fastigium straight in large part, briefly arcuate convergent to the quadrately emarginate cephalic point of fastigium, surface of fastigium hardly at all excavate except at the immediate apex; fastigio-facial angle in profile narrowly rounded rectangular, level of fastigium horizontal, not at all ascending cephalad; facial profile weakly sinuate ventrad to the antennal bases, then straight and moderately oblique to the clypeus; frontal costa as in male except that margins are slightly out-bowed between the paired ocelli and the antennal bases; eyes in general outline and prominence as in male but proportionately of less depth when compared with that of the infra-ocular portion of the genae, being hardly one and one-fourth times as deep as the latter (as 47 to 38). Antennae abbreviate,⁵⁰ slightly shorter than the pronotal disk.

Pronotum with greatest width cephalad across lateral lobes equal to one and one-fifth times the length of the pronotal disk; cephalic margin of disk markedly concave-emarginate with a median tendency toward truncation, caudal margin of disk arcuato-truncate with a very faint median emarginate indication; median carina virtually obsolete on the prozona, evident but weak on the metazona; oblique lateral carinae and transverse sulcus as in male; lateral lobes as in male.

Tegmina in length equal to sixth-tenths that of the pronotal disk, in distal extent and in shape essentially as in male, the greatest width not over five-twelfths of the tegminal length. Wings as in male.

Ultimate abdominal tergite (supra-anal plate) of essentially the same shape and size as in *M. camaguei* with the same sculptural details, although these have been exaggerated in the allotype of *meddix* by alcoholic preservation and subsequent shrivelling; cerci acute, tapering styliform, faintly surpassing in caudal extent the apex of the lateral productions of the penultimate tergite; serrato-dentations on dorso-external margin of dorsal ovipositor valves briefly failing to reach the base of the valves, larger than in *camaguei* and smaller than in *macaca*, ten in number, ventral valves with distal portion slightly more attenuate than in *camaguei*, concavity of ventral surface of distal extremity more markedly bevelled toward median body axis, transverse cutting ridge at base of this concavity strongly lamellate on internal side, lateral shearing teeth as in *camaguei* but all three on each side larger and sharper, lateral plates of ventral ovipositor valves similarly acute-produced but less attenuate than in *M. camaguei*, their dorsal margin straight oblique; ultimate sternite (subgenital plate) much as in *M. macaca*, but lateral margins proximad of the median acute production broadly arcuate to basal lateral portions of sternite, not separated from the production by a definite emargination, as in *macaca*, the full lateral portions of margins being faintly crenulate.

Limbs as in male, except that caudal femora reach to but do not surpass apex of abdomen.

Coloration.—Both specimens known of this species appear to have been dried after liquid preservation, and in consequence their coloration has been affected so seriously that no useful purpose would be gained by describing it in full detail. The male now has a finely vermiculate pattern of buffy

⁵⁰ One antenna, apparently by fusion of two articles, has but 12 clearly defined.

brown on a pale cinnamon-buff ground, the limbs and venter largely chamois, the caudal femora tinted with wood brown, the distal extremities of the same and the proximal ones of the caudal tibiae infusate, the ultimate sternite and much of the last three tergites similarly darkened; oblique lateral pronotal carinae pinkish buff. Female as a whole pale buffy-olive, the oblique lateral pronotal carinae cream-buff, bordered ventrad with blackish fuscous, sutural half of tegmina dull buffy contrasted with the general color of the more sutural section, limbs mottled with brownish olive or even blackish fuscous; antennae buffy; eyes clay color.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Coast below Pico Turquino, <i>allotype</i>	14.6	2.28	1.38	11.4
♀, Coast below Pico Turquino, <i>type</i>	27.7	3.74	2.28	17.2

We have seen only the type and allotype of this species.

Masyntes poeyi ⁵¹ new species

Text-figures 23, 27, 31, 36, 42, 48.

1875. *Mastax gundlachii* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 266. [♂ (but not ♀); "Cuba".]

History.—As has been pointed out in the preceding discussion of the original material of *Mastax gundlachii*, the single damaged male examined by Scudder, and referred by him to that species, is clearly representative of the present form. This original male specimen, which now lacks the head, most of the pronotum and right cephalic and right caudal limbs, was said by Scudder in 1875 to be "broken," and then probably was as incomplete as it is today. Fortunately the apex of the abdomen is intact with its genital features well preserved, which by physical comparison enables us to say that it is identical with the male on which *poeyi* is here based. The female sex of *poeyi* is quite different from that of true *gundlachii*, and we feel confident of the correctness of the association of the sexes of *poeyi* here made. We have already discussed under *gundlachii* the impossibility of determining now exactly whence came the male associated by Scudder with the females to which we have, with full warrant, restricted the name *gundlachii*. As shown in Gundlach's subsequent writings he had collected *Masyntes* over most of Cuba, and prior to 1875, when Scudder described *gundlachii*, Gundlach's travels had taken him from Pinar del Rio to Oriente.

Comparison.—The species *poeyi*, as shown in the key to the females, stands quite apart from the other forms of the genus in the marked marginal angulations present laterad on the female ultimate sternite (sub-genital plate) at the base of the acute median production, while the tegminal outline differs from that of most of the species in that the apices are in no way produced. In the male sex the fastigio-facial angle in profile is roundly

⁵¹ In memory of Felipe Poey, pioneer Cuban zoologist.

obtuse-angulate, definitely less marked than in any other species of which the male is known, while the more produced apex of the ultimate sternite (subgenital plate) distinguishes *poeyi* from *macaca*, which latter possesses a somewhat similar V-shaped disposition of the dorsal margins of the same sternite. The male cerci of *poeyi*, however, are definitely less strongly arcuate than in *macaca*, and more like those of the other species known from the male sex.

Type.—♂; Taco Taco, Pinar del Rio Province, Cuba. April 1-6, 1922. (S. C. Bruner, J. Acuña and C. H. Ballou.) [Academy of Natural Sciences of Philadelphia, Type no. 5592.]

Size and form as in *M. camaguei*, more slender than in the male of *macaca*.

Head is seen in cephalic aspect with width across genae slightly greater than four-fifths that across eyes (as 40 to 48); least interocular width contained six and two-fifths times in the width across eyes (as 7.5 to 48), lateral margins parallel, not converging cephalad, terminating cephalad in low circular nodes, from the ventro-cephalic face of which start the lateral costal carinae, median cephalic border of fastigium shallowly and narrowly emarginate mesad, dorsal surface of fastigium hardly excavate except immediately cephalad where it narrowly passes into the frontal costa; in profile the fastigio-facial angle is seen to be low and broad obtuse-angulate, hardly at all produced, the fastigial plane appreciably arcuate declivent toward the angle; facial line with dorsal fourth subvertical, remainder definite straight oblique declivent; frontal costa with lateral carinae narrowly converging from the fastigio-facial angle to between the paired ocelli, where the carinae are contiguous, thence subcontiguous to between the antennae, then slightly divergent to ventrad of the median ocellus and finally subparallel on ventral portion of face, sulcus of costa well indicated and angularly excavate even ventrad; eyes as prominent as in related forms, in dorso-ventral extent almost equal to one and two-fifths times the least infra-ocular depth of genae (as 36 to 26), basal outline of eye as seen in profile broad ovate, its width subequal to least infra-ocular depth of genae (as 25 to 26). Antennae damaged.

Pronotum with its dorsal aspect as in *camaguei* except that the whole form is slightly broader, the greatest width across lateral lobes cephalad being contained but one and one-fourth times in the greatest median length of the pronotal disk, carinal development, transverse sulcus and proportions otherwise as in *camaguei* except that the ventro-caudal angle of the lateral lobes is non-produced and rectangulate and the caudal margin of the same is definitely straight vertical.

Tegmina not surpassing the caudal margin of the metanotum, slightly less than two-fifths as long as the pronotal disk (as 17 to 45), lanceolate, greatest width at proximal third and contained one and seven-tenths times in the tegminal length, apex very narrowly rounded acute, not at all produced, margins equally arcuate, longitudinal venation as a whole less clearly indicated than in related forms. Wings with their blunt acute apices very briefly surpassing those of the tegmina.

Ultimate abdominal tergite (supra-anal plate) relatively broad trigonal, with the disto-median linguiform process less differentiated than in related forms, paired surface carinae⁵² not strongly emphasized, converging distad, lateral bevels not sharply deflexed; cerci with the bend at three-fifths the length from the base, at a very obtuse angle, less marked than in any of the other species of which the male is known, the distal section slightly arcuate aciculate, in profile with this portion very slightly decurved; ultimate sternite (subgenital plate) definitely compressed, particularly dorsad, its dorsal margins as seen from dorsum as acutely convergent distad as in *M. macaca*, in profile with its distal elevation from median point of the distal margin of the penultimate equal to one and one-fifth times the length in the same view of the ultimate sternite from its lateral base, distal outline in same view faintly sigmoid, membranous base occupying nearly three-fifths the height, dorsal margin in profile arcuately ascending from lateral base and then descending slightly and obliquely to the nearly rectangulate juncture with the distal margin.

Cephalic and median femora moderately robust for genus, nearer what is seen in *M. meddix* than in *camaguei*; caudal femora surpassing the apex of the abdomen by approximately one and two-thirds times the length of the pronotal disk, similar in outline to those of *camaguei*; caudal tibiae with 22 to 24 external and 19 to 20 internal marginal spines.

Allotype.—♀; Pan de Guajaibon, Pinar del Rio Province, Cuba. July, 1934. (J. Natenson.) [Academy of Natural Sciences of Philadelphia.]

Size and general form resembling that of female of *M. camaguei*.

Head with greatest width across genae subequal to that across eyes, interocular width as in same sex of *camaguei*; fastigium, as seen from dorsum, with lateral margins parallel, the cephalic emargination narrow and angulate, the lateral fastigial margins hardly at all converging cephalad, the dorsum of fastigium very shallowly excavate; fastigio-facial angle definitely more obtuse than a right angle, the immediate angle obliquely subtruncate, hardly at all produced, the fastigial plane weakly sinuate declivent to the angle; facial line with its trend suggesting that of male but dorsal fourth is less sharply vertical; frontal costa as in male, except that the lateral margins while contiguous are definitely thickened between the paired ocelli and the antennal bases and ventrad the sulcus is less marked; eyes little prominent, in dorso-ventral extent subequal to the least infra-ocular depth of genae, basal outline of eye as seen in profile broad ovate, its width equal to two-thirds its depth and the same proportion of the least infra-ocular depth of genae. Antennae very short, hardly longer than the dorsum of the head.

Pronotum much as in female of *camaguei* but slightly broader, the greatest width across lateral lobes cephalad being contained one and two-fifths times in the median length of the pronotal disk; cephalad margin of disk transversely subtruncate, caudal margin as in *camaguei* moderately arcuate with a shallow and little evident median emargination; lateral lobes slightly deeper than in *camaguei*, the ventro-caudal angle as much produced as in the female of *camaguei*, the caudal margin nearly straight vertical.

⁵² The male type has the ultimate tergite folded so that its sculpture is less clearly evident than in the paratypic male mentioned beyond.

Tegmina reaching to but not surpassing the caudal margin of the metanotum, in length equal to three-fifths that of the pronotal disk, lanceolate, greatest width at proximal two-fifths and contained two and thirteen-twentieths times in the tegminal length, apex very narrowly rounded acute, not at all spatulately produced, margins about equally arcuate. Wings completely covered by tegmina.

Ultimate abdominal tergite (supra-anal plate) in general shape and sculpture as in *M. camaguei* but proportionately broader and less acute lanceolate, the greatest proximal width to the median length of the tergite as 24 to 37, the principal paired carinae less strongly convergent distad, linguiform distal process larger and broader, in outline more rounded and less trigonal than in *camaguei*; penultimate abdominal tergite with medio-dorsal emargination half again as wide as in *camaguei*; cerci styliiform, tapering, apices aciculate, reaching as far distad as the middle of the linguiform process of the ultimate tergite; serrato-dentations on dorso-external margins of dorsal ovipositor valves extending to the evident base of the valves, 10 to 11 in number, ventral valves with ventral surface of apex strongly concavo-excavate, transverse cutting ridge at base of concavity divided into three dentate points, lateral marginal plate teeth to concavity two to three in number on each side, the more proximal one markedly the larger, one low marginal shearing tooth proximad of the transverse ridge and distad of the ventro-proximal plates, lateral plates of ventral ovipositor valves as in *camaguei* but more attenuate and more slender, the dorsal margin nearly straight oblique; ultimate sternite (subgenital plate) as seen from venter with its distal margin as a whole relatively acute lanceolate produced, the more sharply acuminate median section definitely cut off from the more lateral portions of the margin by distinct and moderately emphasized rectangulate shoulders, which have on their mesal side a shallowly concave emargination flanking the lateral bases of the median production.

Cephalic and median limbs with the femora more definitely carinate than in the female of *camaguei* but otherwise essentially the same. Caudal femora essentially as in *camaguei*; caudal tibiae with 24 to 26 external and 20 internal marginal spines.

Coloration.—Male with base color ranging from dull ecru-olive (type) to clear dull green-yellow (paratype), the face, lateral lobes of the pronotum, pleura and limbs palest in tone; occiput washed with sayal brown, eyes tawny-olive to buckthorn brown, antennae (paratype) with two proximal articles paris green, remainder garnet brown, buccal region (paratype) washed with paris green; lateral carinae of pronotum dully pencilled with pale ochraceous-buff; cerci, lateral portions of penultimate and antepenultimate tergites, most of ultimate tergite (supra-anal plate) and certain proximal and disto-dorsal sections of the ultimate sternite (subgenital plate) washed with fuscous; distal four-fifths of cephalic and median tibiae garnet brown, distal extremity of caudal femora and more restrictedly the proximal section of the caudal tibiae washed with clove brown, caudal tibiae with distal fifth and most of caudal metatarsus garnet brown.

Female almost entirely bister, with an under color of tawny-olive to clay color which shows through in many areas of small extent, usually scattered on the limbs; eyes mottled fuscous over snuff brown, antennae clay color;

pronotum with oblique lateral carinae lined with cinnamon-buff, lateral lobes ventrad of oblique carinae darker and more definitely fuscous than pronotal dorsum; cephalic and median femora distinctly but not sharply pale annulate at about distal third, caudal femora with ventral sulcus light ochraceous-buff the bordering carinae ticked alternately light and dark.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Taco Taco, <i>type</i>	14.8	2.36	.97	12.3
♂, San Vicente, <i>paratype</i>	16.3	2.44	1.14	12.0
♀, Pan de Guajaibon, <i>allotype</i> ..	30.9	3.91	2.28	18.9

In addition to the type and allotype we have before us, from the collection of the Museum of Comparative Zoology, a single male paratype from San Vicente, Pinar del Rio, Cuba, taken July 26 to August 5, 1939, by C. T. Parsons. This specimen has preserved more of the natural coloration than the type and has been drawn upon in the preceding color description.

It shows no noteworthy structural differences from the male type.

Masyntes exitus ⁵³ new species

Text-figures 37, 43, 49.

Unfortunately, as is the case with *M. gundlachii*, we do not know the male of this species, which in the female sex has in profile the least production of the fastigio-facial angle of any form of the genus we have seen. In addition the serrulato-crenulate character of the lateral margins of the ultimate sternite (subgenital plate) of that sex is distinctive. The key to the species gives in the section devoted to the female sex, the features which will serve to identify this species as compared with its relatives.

Type.—♀; Baracoa, Oriente Province, Cuba. September, 1901. (August Busck.) [United States National Museum.]

General size and form much as in *M. poeyi*, with the female sex of which the following description is largely comparative.

Head with greatest width across eyes and genae subequal; fastigium as seen from dorsum with its greatest breadth but one-sixth that of head across eyes (as 10 to 60), the lateral margins moderately incurved cephalad to the narrow and subquadrately cut cephalic emargination of the fastigium, surface of fastigium shallowly and broadly subexcavate; fastigio-facial angle in profile broadly obtuse, hardly at all produced, much less evident than in the weakly produced condition found in *poeyi*, plane of fastigium very considerably declivent to the angle; facial line briefly low arcuate to between the antennal bases, then nearly straight oblique ventrad; frontal costa with margins virtually contiguous for about half the distance from between the paired ocelli to the fastigial level, diverging dorsad, similar to but more separated than in the females of *poeyi* from the paired ocelli to the median one, ventrad of latter as in *poeyi*. Eyes in profile with greatest dimension equal to one and one-fifth times the least depth of the infra-

⁵³ I. e. a place of going out, in allusion to its occurrence at the eastern point of Cuba.

ocular portion of the genae (as 45 to 37), in basal outline the eye is broad ovate, the greatest breadth equal to two-thirds the greatest eye depth. Antennae damaged.

Pronotum in general very similar to but more slender than in the female of *poeyi*, the greatest cephalic width across lateral lobes being contained slightly less than one and one-quarter times in the median length of the pronotal disk (as 53 to 67); cephalic margin of disk very faintly arcuate-emarginate, caudal margin of same transversely subtruncate, median carina definitely indicated on the metazona, subobsolete on the prozona; oblique lateral carinae distinct but less strongly sculptured than in *poeyi*; lateral lobes of pronotum with proportions and margins as in *poeyi*, sculpturing less pronounced.

Tegmina reaching to immediate base of proximal abdominal tergite, acute lanceolate, their apices subproduced although not spatulate, greatest width mesad and contained two and one-third times in the tegminal length, sutural margin definitely more strongly arcuate than the costal, emphasis of veins and surface sculpture much as in *poeyi*. Wings not surpassing tegmina, completely covered by latter.

Ultimate tergite (supra-anal plate) compressed abnormally in type so that exact proportions cannot accurately be determined, but sculpture is as in *poeyi* and related species except that the distal linguiform process is smaller than in *poeyi*, although of essentially the same shape; exact width of medio-dorsal emargination of penultimate tergite cannot be determined on account of compression in unique type; cerci as in *poeyi*; serrato-dentations on dorso-external margins of dorsal ovipositor valves not quite reaching the evident base of the valves, eight to nine in number, ventral valves with ventral surface of apex strongly concavo-excavate with a definite surface trend toward the internal margin, transverse cutting ridge at base of concavity as in *poeyi* but not as clearly divided into three parts, lateral marginal plate teeth to concavity two in number on each side, lateral plates of ventral ovipositor valves as attenuate as and very similar in shape to those of *poeyi*; ultimate sternite (subgenital plate) as seen from venter relatively broad, its distal margin subrectangulate produced, the apex briefly subacute and separated from the more lateral sections of the margin by a shallow and subangulate emargination, from which laterad the sides of the margin are straight oblique, and definitely crenulato-dentate to immediately ventrad of the ventral margin of the lateral plates of the ventral ovipositor valves, whence they are arcuate and also in part at least crenulate to the lateral bases of the sternite.

Caudal femora briefly surpassing apex of abdomen; caudal tibiae with 20 external and 18 internal marginal spines.

Coloration.—Dresden brown, slightly paler on the face, venter touched with russet. Eyes mottled zinc orange to dresden brown, somewhat speckled with fine fuscous stipplings; lateral lobes of pronotum ventrad of oblique lateral carinae washed with weak mummy brown, the carinae but little paler than the general color; tegmina with a weak medio-longitudinal bar of mummy brown; caudal femora rather irregularly mottled with mummy brown, the distal extremity more solidly infusate with the same; caudal tarsi lumiere green, darkened to biscay green distad on the third article.

Length of body, 28.3 mm.; length of pronotum, 3.42; length of tegmen, 2.11; length of caudal femur, 17.4.

The type of this species is unique.

EUMASTACOPS⁵⁴ new genus

This previously unrecognized genus is erected for certain described and a number of new South American species, which show certain apparently superficial tendencies toward *Temnomastax* and *Masyntes*, but are more nearly related to *Pseudomastax*, and similarly but more distantly to *Paramastax* and *Eumastax*. From the latter, with which it shares hyaline alar organs (and particularly non-opaque tegmina), *Eumastacops* can be distinguished by the definite, yet not pronounced, production of the vertex, which is clearly evident dorso-cephalad of the eyes when seen in profile, the paired submammillation of the lateral areas of the fastigial surface and the median impression of the same, the lack of even continuity of the lateral carinae of the frontal costa with similar lateral bordering carinations of the fastigium, the typically strongly sellate pronotum, and by the ultimate sternite (subgenital plate) of the male being short and transverse, with its ventral base membranous, instead of cymbiform and completely chitinated. From *Paramastax* the present genus can be distinguished by the hyaline and non-opaque tegmina and wings, the general sculpture of the fastigio-facial angle, which in *Paramastax* more nearly approximates that of *Eumastax*, and by the radiate field of the wings, when the same are fully functional organs, not being highly specialized and cycloid, as it is in the fully alate genotype of *Paramastax*. From *Pseudomastax*, which we feel is the most nearly related genus, *Eumastacops* can be distinguished by the hyaline and not semi-opaque tegmina, the virtually untinted clear hyaline wings, by the ventro-caudal angle of the lateral lobes of the pronotum of the male usually being acute and even produced to a variable degree, and in the same sex by the virtual absence of marked lobate ventro-caudal productions of the lateral areas of the penultimate and antepenultimate tergites (except of the antepenultimate one in *E. unca*).

From the West Indian genus *Masyntes*, which is a much more distant relative, *Eumastacops* can be distinguished by a number of features, among them the less sharply medio-longitudinally divided fastigium, the less longitudinal but usually more markedly sellate pronotum, by the proximal antennal article being nearly or quite twice as long as the second article, and the second article of the caudal tarsi usually being much less than half as long as the proximal article.

Generic features.—Brevialate to fully alate. Head with occiput arcuately ascending to interocular region, which is relatively narrow; fastigium as

⁵⁴ From *Eumastax* and *ὄψις* the face or appearance, in allusion to its resemblance to that genus.

seen from dorsum margined laterad by low but definite submamillations, nodes or straight or sublunate brief carinations, which in profile give to the fastigio-facial juncture an angulation ranging from obtuse-angulate to moderately acute, this evident in lateral view dorso-cephalad of the eyes, the median portion of the fastigium more or less impressed, occasionally cut off by sculptural details from the sulcation of the frontal costa. Frontal costa narrow, particularly between the antennae, sulcate, margins carinate; supplementary (lateral) facial carinae distinct, but slightly, if at all, diverging ventrad of the eyes. Antennae short, weakly subspatulate distad, twelve-jointed, the proximal article from one and two-thirds to over twice as long as the second one, the usual tooth on the ninth article. Pronotum sellate (at least so in *E. unca*), concavely so dorsad in some species; cephalic margin of disk truncate to shallowly concave, caudal margin of same obtuse-angulate to arcuate produced, least developed in the brevialate species (*unca*); median carina ranging from subobsolete to definitely and uniformly indicated, no lateral carinae present except for rudiments in the brevialate *unca*; caudal portion of metazona of disk cribroso-punctulate or transversely rugulose; lateral lobes longitudinal, from one and one-half times to nearly twice as long as greatest (caudal) depth, ventral margin lightly sigmoid, ventro-caudal angle ranging from but slightly acute (*caligo*) to a narrowly acute-produced process (*unca*). Tegmina ranging in size from less than twice as long as the pronotal disk (*unca*) to fully developed, reaching distad nearly to (♀) or quite surpassing (♂) the caudal femoral apices, main venational elements indicated in all, in brevialate type thickened and sub-opaque, in fully alate forms hyaline, apices rounded. Wings approximately equal to tegmina in development, structurally complete; hyaline. Mesosternum narrower than metasternum, mesosternal interspace strongly transverse, internal margins of lobes converging cephalad, metasternal lobes contiguous. Male cerci ranging from tapering, undivided and falcate to nearly straight, stout and apically bidentate; ultimate sternite (subgenital plate) of male with ventro-proximal portion broadly membranous, chitinized section reduced to a disto-dorsal marginal frame, heaviest and deepest in the brevialate *unca*; penultimate and antepenultimate tergites in the male laterad at most either but slightly or brevi-acute produced ventro-caudad, never strongly lobate. Female ultimate sternite (subgenital plate) ranging from deeply bisemarginate into a trilobate structure (*trifida*) to a trigonal, medially rectangulate to acute structure, the apex of which in one case (*plebeja*) is briefly and divergently bis-incised. Cephalic and median femora slender stouter in *unca*, simple, uninflated, sub-bicarinulate dorsad. Caudal femora surpassing, or at least equalling (females of several species), apex of abdomen, dorsal carinae microscopically serrulate, distal angles of femora (i. e., median, genicular arches and genicular lobes) spinose; caudal tibiae slightly longer than femora, spines of internal margin markedly biseriate in length and surpassing in size those of external margin; caudal metatarsus over twice as long as the second and appreciably longer than the third tarsal article; dorsad surface of former broadly and shallowly sulcate, carinate laterad, these microscopically serrulate, disto-externally with a definite spiniform tooth; tarsal claws unequal, internal (caudal) the larger, arolium well developed.

Genotype.—*Eumastacops caligo* new species.

The species of this genus form a well-marked aggregation, which phylogenetically were probably derived from the same base stock as *Eumastax* and *Pseudomastax*, but at the same time through convergence suggest, superficially, relationship to the Antillean *Masyntes*, and a less evident one to *Temnomastax* and the Nearctic genera of the subfamily. The more intimate character of the relationship with *Pseudomastax*, as compared with that with *Eumastax*, has already been emphasized, and the latter genus seems to have had a rather different history. The cohesiveness of the area from which the species of the genus are known, aside from the provisionally referred *versicolor*, which we have not seen, and the similar areal grouping of the species of *Pseudomastax* in an in part overlapping but to a considerable degree contiguous and complementary region, adds force to the argument of common ancestry. Where and when they may have been evolved from such a common ancestor cannot be determined from such evidence as is now available, but this may have taken place in the area of the present upper Amazon and the eastern Andean foothills, probably even having been started along the course of differentiation prior to the Andean uplift.

In *Eumastacops* we find among the species evidence of the same range in alar development now known in *Eumastax* and *Paramastax*, as well as in *Masyntes*. Apparently in the Eumastaces there is deep-seated instability in this respect, implying rather secondary importance of wings and tegmina. While but a single species of *Eumastacops* now known is brevialate, this, as with a similar case in *Eumastax*, is a species found at low elevations under purely tropical conditions and not, as is so often the case with brevialate forms, at high or relatively high elevations and in temperate environments.

Distribution.—The seven species referred to *Eumastacops* from definite material have a cohesive and interesting distribution. They are known from British Guiana and central Amazonia as far west as Olivença, State of Amazonas, Brazil, and Cavinás, Beni district, Bolivia, and east to Oriximína on the Trombetas River, a northern affluent of the Amazon emptying into the latter near Obidos, State of Pará, Brazil. No form of the genus is known at present from Amazonian Peru, although considerable material is available from that area. Similarly the much more thoroughly examined lower Amazon district about Belem (Pará) has produced no member of the genus. The distribution of this genus in the Guianan-Amazonian region is further evidence of the importance of a former faunal avenue across northern Brazil into British Guiana, as well as of the often correlated fact that species and genera so distributed may be absent from lower Amazonia. We are including in this genera a single Paraguayan species (*versicolor*) described by Burr. This action is not from conviction as to the affinity of

Burr's species, but is merely due to the fact that from the description it fits nowhere else as well. It has been placed in the key and discussed in the systematic treatment, but the acquisition of material, not at present available, may show it to be quite distinct generically.

Subsidiary Units.—The forms here referred to *Eumastacops* are clearly referable to six species' groups, based on features such as the pronotal form, alar type and male and female genitalia. In addition in the case of one species it seems necessary for relative consistency of treatment to segregate this as representing a distinct subgenus. The subsidiary entities thus would be as follows:

Subgenus *Arawakella* new subgenus

Unca group. Including *unca* new species.

Subgenus *Eumastacops* s.s.

Trifida Group. Including *trifida* new species.

Nemorivaga Group. Including *nemorivaga* new species.

Militaris Group. Including *militaris* (Gerstaecker).

Plebeja Group. Including *plebeja* (Gerstaecker).

Caligo Group. Including *parishi* and *caligo* new species.

Key to Species

As three of the seven species here referred to the genus, on the basis of material examined, are known solely from the female, the following table is based very largely upon features of that sex. Doubtless when the males of all of these are known we will find they have excellent genitalic characters, which will supplement or make necessary the modification of emphasis here placed upon purely female characters. In the absence of these males it has been necessary to rely upon the evidence of the females, which sex is known of all seven species examined. The present key is offered with full realization of this unilateral application.

1. Tegmina no longer than head and pronotum combined. (Cerci of male strongly incurved, falcate. Ultimate sternite (subgenital plate) of female with distal margin almost rectangulate, not fissate.) (British Guiana and Amazonian Brazil.) Subgenus *ARAWAKELLA* new subgenus.....*unca* new species
- Tegmina distinctly longer than head and pronotum combined. (Male sex of certain species not known.) Subgenus *EUMASTACOPS* s.s.....2
2. Ultimate sternite (subgenital plate) of female strongly divided into three lobes, margin briefly and narrowly fissate or excised mesad. (Male sexes not known.).....3
- Ultimate sternite (subgenital plate) of female with distal margin produced but undivided.....5

3. Ultimate sternite (subgenital plate) of female deeply and markedly trilobate, one acute process mesad, and rounded lateral ones, the divisions extending half-way to base of sternite. Caudal margin of pronotal disk obtuse-angulate. (British Guiana).

trifida new species

Ultimate sternite (subgenital plate) of female with distal margin briefly and narrowly fissate mesad, flanking areas contiguous and fission occupying but one-sixth of length of sternite, or same margin is "excised" mesad. Caudal margin of pronotal disk rounded. (Male sexes unknown.).....4

4. Size smaller (♀, body 16.5 mm.). Ultimate sternite (subgenital plate) of female with margin "excised" mesad. Tegmina hyaline. Caudal femora with external paginal pattern regularly lineate with green, longitudinal carinae lineate with green; caudal femoral apices infusate. Caudal tibiae bluish. (Paraguay.).....*versicolor* (Burr)

Size larger (♀, body 22.5 mm.). Ultimate sternite (subgenital plate) of female with margin briefly and narrowly fissate mesad. Tegmina strongly tinted with greenish. Caudal femora with external paginal pattern not lineate with green; longitudinal carinae lineate with black; caudal femoral apices not infusate. Caudal tibiae olive-brown (discolored?). (Amazonas, Brazil.).....*plebeja* (Gerstaecker)

5. Distal margin of ultimate sternite (subgenital plate) of female not as sharp as a rectangle. Caudal femora with paginal pattern of both faces definitely marked by darker chevrons. (Color pattern strongly contrasted. Tegmina of male multiareolate distad.) (Amazonas, Brazil.).....*militaris* (Gerstaecker)

Distal margin of ultimate sternite (subgenital plate) of female rectangulate to acute-angulate. No marked paginal pattern evident on caudal femora.....6

6. Distal margin of ultimate sternite (subgenital plate) of female not regularly acuminate, the lateral sections of same sigmoid and more strongly convergent distad than proximad. (British Guiana and Amazonian Brazil.).....*parishi* new species

Distal margin of ultimate sternite (subgenital plate) of female regularly and evenly acuminate, the lateral sections of same uniformly convergent throughout7

7. Head less strongly narrowed, proportionately broader, eyes less decidedly prominent; infra-ocular portion of genae and face marked with black. Pronotum shorter and not as strongly sellate, ventro-caudal angle of lateral lobes but faintly acute. Tegmina with apices not at all falcate. Wings subcycloid, axillary vein no more widely separated from anal vein than ulnar vein is from latter. (Amazonas, Brazil.)

caligo new species

Head more strongly narrowed, proportionately deeper, eyes more decidedly prominent; infra-ocular portion of genae and face not marked with black. Pronotum more longitudinal and strongly sellate, ventro-caudal angle of lateral lobes distinctly acute-produced caudad. Tegmina with apices subfalcate. Wings narrow, not cycloid; axillary vein much more widely separated distad from anal vein than ulnar vein is from latter. (Amazonas, Brazil and Beni, Bolivia.)

nemorivaga new species

ARAWAKELLA⁵⁵ new subgenus

Separable from the restricted subgenus *Eumastacops* by numerous features, among them the greatly reduced alar organs, which, however, retain their full structural development, the intimation of lateral carinae on the pronotal disk, the non-concave, yet sellate form of the pronotum, the strongly incurved and falcate male cerci, the reduced membranous area at the base of the ultimate sternite (subgenital plate) of the male and the development laterad of the ultimate sternite (subgenital plate) of the female into deep, broadly reflexed, subvertical bounding walls. In addition the whole apex of the abdomen of the male is relatively deplanate, even though appreciably recurved.

Subgeneric characters.—Brevialate in both sexes, tegmina moderately coriaceous, venation developed on tegmina, but areolations small. Pronotum sellate but with non-concave dorsum, indications of lateral carinae of disk present in both sexes. Male cerci undivided, falcate, incurved, spiniform acute at apex. Male ultimate sternite (subgenital plate) in caudal aspect transverse trapezoidal, distal margin abruptly transverse truncate, membranous area at base narrow, chitinous section in caudal aspect relatively deep. Female ultimate sternite (subgenital plate) with distal margin as a whole angulately produced mesad and serrulate, lateral sections of sternite broadly reflexed subvertical lamellate flanges encircling the bases of the ventral ovipositor jaws.

Genotype of subgenus.—*Eumastacops unca* new species.

*Eumastacops unca*⁵⁶ new species

Text-figure 50; pl. 1, figs. 4, 5;
pl. 2, figs. 16, 17.

This peculiar species can at once be distinguished from the other forms by the features given for the subgenus and those set forth in the above key. Although abbreviate the tegmina are fully veined, the wings equal to the tegmina in length, the pronotum shows rudiments of lateral carinae of the disk, and the ultimate sternite (subgenital plate) of the male is largely chitinized, with less exposed membranous tissue at its base than in any of the other species of the genus of which we have seen males. The distal margin of the same sternite is broadly and sharply transverse truncate, quite unlike that of the other species known from the same sex.

Type.—♂; Demerara River, British Guiana. [Academy of Natural Sciences of Philadelphia, Type no. 5397.]

Size relatively small; form moderately slender, brevialate.

Head with fastigio-facial angle in profile slightly more obtuse than a right angle, yet definitely evident nearly dorsad of the eyes; fastigium as seen from dorsum quite narrow, the occipital margins of the eyes regularly converging to the quite short fastigium, the impressed area of which is

⁵⁵ From the Arawak people, an important stock of the aborigines of northern South America.

⁵⁶ I. e. *hooked*, in allusion to the shape of the male cerci.

slightly but definitely broader than long, lateral borders carinate, limited on dorsum to immediate fastigium, mesal surface of same shallowly impresso-excavate with trace of a median carinula, the cephalic border of fastigium as seen from dorsum broadly but not deeply V-emarginate; frontal costa very narrow, particularly ventrad over face, its bounding carinae rather deeply converging immediately ventrad of fastigium, width of face across genae as to greatest width across eyes as 5.4 to 6.6. Eyes are seen from dorsum moderately prominent, in basal outline ovate, the greatest width contained slightly more than one and one-third times (as 3.8 to 5.2) in greatest depth, the latter equal to one and two-thirds times the length of the infra-ocular sulcus. Antennae largely lacking, proximal and second article (all preserved) relatively long.

Pronotum subsellate but not concave, in profile the dorsal line being virtually straight, greatest width of disk caudad approximately half that of discal length; cephalic margin of disk arcuato-truncate, caudal margin of same low obtuse-angulate produced; median carinula of disk very low and fine, indications of lateral carinae present as low incomplete ridges, very faintly clepsydral, prozonal section of disk slightly longer than metazonal portion, transverse sulcus appreciably but not deeply incised; lateral lobes longitudinal, the greatest caudal depth contained twice in the dorsal length of the lobes; cephalic margin strongly arcuate and broadly rounding, entirely without any ventro-cephalic angulation, into the virtually straight ventral margin; caudal margin straight and nearly vertical except for the ventral fifth, where it obliquely joins into the marked and acute-angulate ventro-caudal production; principal transverse sulcus well impressed dorsad on the lobes.

Tegmina elliptical lanceolate, faintly less than twice as long as pronotal disk, reaching to the distal third of the third abdominal tergite, greatest tegminal width equal to one-third the tegminal length; texture subcoriaceous, venation marked and elevated; costal margin nearly straight, but obscurely arcuate, apex evenly and broadly rounded, sutural margin faintly arcuate; marginal field subequal, no proximal lobation, evenly narrowing in distal third, greatest width almost equal to two-thirds that of the discoidal field at broadest point (distal fourth); anal field subequal in width to marginal field, very gradually narrowing distad; mediastine vein distinct, discoidal vein pronounced, median indicated in distal half, ulnar and anal veins marked, cross nervures numerous and marked but rather irregular in disposition, the resulting areolations varying in size and shape. Wings completely hidden by tegmina.⁵⁷

Interspace between the mesosternal lobes transverse, the caudo-internal portion of the latter obliquely obtuse-arcuate; foramen at the caudal base of the inter-metasternal suture strongly transverse, narrowly subreniform, opening cephalad.

Abdomen with apex subdeplanate yet moderately recurved, the deplanation quite evident when the apex is viewed in caudal aspect, which emphasizes the modification of the whole structure of the area to conform with the general deplanation: penultimate tergite with its disto-dorsal margin

⁵⁷ The single known male is in much too delicate condition to attempt to spread the wings.

strongly arcuato-emarginate between the cercal bases, as seen in dorsal aspect the whole tergite expanded laterad, compared with antepenultimate one, the ventro-caudal portion of the tergite is carried obliquely beneath the cercal bases, and combined with a similar extension of the antepenultimate tergite to form a faintly acute production, which, however, does not surpass the distal margin of the penultimate sternite, and the ventral margin of which (i. e., of this part of the antepenultimate tergite) is definitely arcuate: ultimate tergite (supra-anal plate) acute trigonal, the apical half slightly more acute than the converging margins of the proximal half, the apex finely acute; surface of ultimate tergite concavely impressed where it joins the penultimate tergite, apparently submembranous, distal part more chitinous, faintly decurved distad. Cerci tapering in proximal two-fifths, thence distad equal in thickness to the distal fifth which is spiniform acute and polished, seen from dorsum the whole cercus distad of the straight proximal two-fifths is falcately inbowed, the apices crossing when the cerci are not extended, in profile the cercal axis is seen to be virtually plane, not at all decurved. Ultimate sternite (subgenital plate) short, transverse, in caudal aspect subtrapezoid, the dorsal margin sharply transverse truncate, the lateral ones nearly straight, as seen in caudal aspect moderately converging dorsad to the very definite but obtuse dorso-lateral angles, ventro-proximal membranous portion narrow, not more than half the median depth of the chitinous portion of the sternite as seen in caudal view, its dorsal border definitely bisarcuate; in lateral view the ultimate sternite (subgenital plate) is seen to be directed moderately dorso-caudad; its caudal surface rather deplanate and in no way bullate: penultimate sternite relatively large, in transverse section rather low arcuate, in ventral view somewhat widening distad, the distal margin in ventral aspect transverse, faintly obtuse-angulate, in caudal aspect moderately biconcave.

Cephalic and median limbs of moderate build, the femora equal in length to one and one-third times the length of the pronotal disk, both with the paired dorsal carinulae indicated but not strongly. Caudal femora equal in length to very slightly more than three-fourths of the body length, surpassing the apex of the abdomen by a distance but little less than the tegminal length, inflation of proximal half pronounced, pattern of external pagina very shallowly etched: caudal tibiae briefly surpassing the caudal femora in length, the external spines 20 to 21 in number, internal spines 19 to 20, the biseriata arrangement of the latter pronounced; caudal metatarsus slightly longer than third tarsal article (as 30 to 27), distal and median pulvilli relatively large, contiguous, proximal one smaller and removed from the median one by a distance nearly equal to half the proximal's length: arolium more strongly ampliate on cephalic (or external) side than on the other.

Allotype.—♀; Itacoatiara, State of Amazonas, Brazil. October 22, 1919. (H. S. Parish.) [Hebard Collection.]

Differing from the above description of the male sex in the following noteworthy features.

Size appreciably larger than in male; form and alar development similar.

Head with facio-fastigial angle in profile virtually a right angle, slightly more evident dorsad of the eyes than in male; fastigium as seen from dorsum

essentially as in male but proportionately larger and more strongly transverse, the lateral borders well carinate, the fastigial disk plane, level with surface of contiguous and confluent occiput, no median carinula present, cephalic border of fastigium, as seen from dorsum, very shallowly concave-emarginate; frontal costa as in male, its carinate margins more evenly diverging dorsad where they pass to fastigium; width of face across eyes but slightly greater than across genae, proportionately much less than in male. Eyes, as seen in lateral view, with greatest width contained one and one-half times in greatest depth, the latter equal to one and two-fifths times the length of the infra-ocular sulcus. Antennae very short, their length not greater than one and one-fourth times the depth of the eye, the proximal article quite long, the second quite short and equal to but two-fifths the length of the proximal one, remaining articles individually short, distad subdepressed and subclavate, apex blunt acute.

Pronotum much as in male but proportionately broader and less compressed, the greatest caudal width of disk equal to five-eighths of the discal length; indications of lateral carinae of disk less evident than in male but with the same general directional trend; lateral lobes as in male but less strongly longitudinal, the caudal depth being approximately three-fifths of the dorsal length of the lobes.

Tegmina in general form and development much as in male, in length equalling faintly less than twice that of the pronotal disk, yet reaching to the middle of the third abdominal tergite; costal margin nearly straight, yet suboblique, in proximal half, at middle arcuately rounded to the oblique, nearly straight distal half, which evenly passes into the strongly rounded apex, sutural margin moderately arcuate: marginal field broad mesad, widening from base and narrowing distad of middle, but with field reaching almost to apex of tegmen, the greatest (median) width equal to approximately three-tenths that of the whole tegmen or of two-fifths of the discoidal and anal fields combined; anal field broad, in breadth subequal to marginal, of more even width, less sharply narrowing proximad or distad, its venation more densely and irregularly reticulate than in male; remainder of venation fundamentally as in male and with similar instability in emphasis and balance of subsidiary elements, which are also more numerous. Wings when closed extending caudad as far as the apices of the tegmina, fully formed and capable of being unfolded, apex rotundato-truncate, venation with longitudinal elements fully developed and cross nervures present but fewer than in more amply developed wings, areolets hardly more irregular than in the latter.

Foramen between the metasternal lobes more narrowly transverse, less reniform, acutely narrower laterad and more definitely paired than in male.

Abdomen more compressed and more definitely medio-longitudinally carinate dorsad than in the male; penultimate tergite with a cephalad-directed cuneiform excision dorso-mesad, bordered laterad by straight distad-diverging margins, a narrowing continuation of the same impression, but sculpturally only and not by excision, extends cephalad over the same area of the antepenultimate tergite, ventro-caudal sections of the lateral parts of these tergites very sharply acute-produced beneath the cercal bases; ultimate tergite (supra-anal plate) elongate trigonal, apex decidedly acute, lateral margins straight oblique convergent, the whole definitely surpassing

the cercal apices, its greatest proximal width contained one and two-fifths times in the length of the tergite distad of the penultimate, surface with a shallow transverse impression and proximad of this a medio-longitudinal one, lateral bases of the tergite subvertical flattened areas, carinulately delimited from the more dorsal area; cerci simple, styliiform, apex acute, failing to reach as far distad as the acute apices of the infra-cercal plates; ovipositor jaws relatively stout, subcompressed, teeth robust, dorso-external ones eight to nine (exclusive of distal point), ventro-externals five to seven (also excluding distal); ultimate sternite (subgenital plate) large, U-shaped in transverse section, deep lateral wings being vertically cut off from the transverse subarcuate broad venter by subcarinate, faintly caudad converging borders, distal margin of sternite, as seen from venter, faintly more obtuse than a right angle, its immediate apex narrowly recurved, the margin irregularly serrulato-denticulate.

Limbs essentially as in male; cephalic and median femora in length approximately equal to one and one-twelfth (cephalic) or one and one-fifth (median) times the pronotal length; caudal femora in length equal to thirteen-twentieths of the body (included ovipositor jaws), surpassing the apex of the abdomen by a distance equal to slightly less than half of tegminal length; caudal tibiae with 21-23 external and 20-22 internal spines.

Coloration.—General base tone of male honey yellow becoming light yellowish olive on the limbs, particularly the caudal femora, and the genae; occiput washed with fuscous, particularly as a medio-longitudinal line and several incomplete postocular ones, eyes russet; pronotum with ventral side of rudimentary lateral carinae narrowly marked with fuscous; tegmina nearly as dark as clove brown, paling slightly proximad; abdomen with six proximal tergites washed with prout's brown in distad progressive intensity, the same paling laterad on each tergite, the wash also indicated laterad on the seventh and eighth tergites, the dorsum of which is of the clear general color, apex of abdomen almost solidly prout's brown to mummy brown, venter of abdomen deep olive; dorsal and ventro-external carinae of caudal femora pencilled with blackish, caudal tibiae and tarsi dull olive, clouded with fuscous, spines blackish. General base tone of female between honey yellow and chamois (perhaps decolored to some extent by desiccation), virtually lacking the infuscation noted in the male, the antennae distad of the second article saccardo's umber becoming fuscous near apex; eyes tawny-olive; abdomen not distinctly patterned except for a narrow transverse intermarginal distal darkening on the tergites; tegmina and wings washed with dilute cinnamon-brown; limbs of the general color, the caudal femora lineate as in the male, the caudal tibiae somewhat darkened, the spines less completely blackish.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, <i>type</i>	15.8	2.36	4.07	10.6
♀, <i>allotype</i>	21.6	2.93	5.37	14.3

Distribution.—This most striking species and subgenus, is at present known only from two localities, i. e., those of the type and allotype, the

Demerara River of British Guiana and Itacoatiara on the Rio Trombetas in eastern Amazonas, Brazil. For comments on this distribution see above under the generic distribution.

Remarks.—We have seen only the type and allotype.

EUMASTACOPS s.s.

The restricted subgenus has already been contrasted on a preceding page with the subgenus *Arawakella*, to which reference should be made for the features distinguishing the two entities.

Subgeneric characters.—Fully alate in both sexes (as far as known), tegmina not at all coriaceous, their venation of open areolate type. Pronotum weakly to deep concave sellate dorsad, no indications of lateral carinae of disk in either sex (as far as known). Male cerci styliform, narrowly recurved, sharply hooked and tapering and inbent but not falciform, or apex briefly bifid (as far as known). Male ultimate sternite (subgenital plate) never transverse trapezoidal in caudal aspect, nor marginally transversely truncate, chitinous distal area very shallow, basal membranous area deep (as far as known). Female ultimate sternite (subgenital plate) with distal margin variously produced, trilobate, acute produced or even narrowly fissate at apex, margin non-serrulate, lateral outline of sternite unreflexed or if lamellately developed then as special lobate structures (*trifida*) and not as broadly attached lateral abutments of the sternite.

Genotype.—*Eumastacops caligo* new species.

*Eumastacops trifida*⁵⁸ new species

Text-figure 51.

While the male sex of this very marked species is not known as yet, the deeply divided ultimate sternite of the female is an unusual diagnostic feature. In certain respects *trifida* seems to more nearly approach *unca*, and in other *plebeja*. It is, however, very distinct from either of these, and the male sex, when discovered, will probably be found to possess definite distinguishing characters.

Type.—♀; Potaro Landing, Potaro River, British Guiana. February 21, 1921. [Academy of Natural Sciences of Philadelphia, Type no. 5587.]

Size medium; form fully alate; surface relatively smooth.

Head with occiput moderately arcuate ascendant to the plane of the fastigium, which latter from the interocular point of the vertex is but two-thirds as long as its greatest width, this latter being hardly greater than the interocular width at the vertex, lateral margins of the fastigium briefly sublnate in form as seen from dorsum, moderately converging cephalad, but slightly elevated above the discal surface of the fastigium which is plane and continuous with, but faintly raised above, the occipital level, very briefly passing into frontal costa cephalad, no median carinula present, cephalic border of fastigium as seen from dorsum moderately concave; in lateral view the fastigio-facial angle is seen to be rounded rectangulate by

⁵⁸ In allusion to the pronounced division of the ultimate sternite of the female into three sections.

the extremity of the lateral fastigial carinate borders, the angle definitely but briefly visible dorso-cephalad of the eye: frontal costa narrow ventrad of the median ocellus, dorsad of same the carinate lateral borders regularly but gradually diverge dorsad, groove of sulcus moderately impressed; lateral (supplementary) facial carinae not markedly developed, but slightly divergent ventrad below the eyes. Antennae relatively short, second joint hardly equalling half the length of the proximal one, the ten articles distad of the second together hardly twice as long as the proximal and second combined, the articles short, third, fourth and fifth slender, thence they are weakly expanding and sub-depressed, the apical article blunt acute. Eyes but weakly prominent, as seen in cephalic aspect the width across them is but faintly greater than that across genae (as 9.3 to 9), in basal outline the eye is broad ovate, the depth equal to one and one-sixth times the greatest width, the depth of the infra-ocular sulcus contained one and one-half times in eye depth.

Pronotum sellate, in profile with the dorsal line straight caudad to the metazona where it is moderately ascending to the caudal margin; greatest caudal width of disk contained approximately one and one-third times in the discal length (as 5.5 to 9); cephalic margin of disk arcuato-truncate with a low median subangulate point, caudal margin obtuse-angulate with the immediate angle broadly rounded; median carinula present, but very low and subobsolete on the prozona, more decided on the metazona, metazonal surface cribrosely rugulose, no true indications of lateral carinae, the discal surface of prozona broadly rounding into the lateral lobes, anterior transverse sulcus more deeply impressed than the principal one, which on the dorsum is less evident than on the lateral lobes, the anterior sulcus bisecting the disk in the middle, the principal one at the caudal third: lateral lobes moderately longitudinal, the greatest caudal depth contained slightly more than one and one-third times in the dorsal length of same; cephalic margin with ventral half broadly arcuate into the faintly sigmoid ventral margin, caudal margin straight, faintly oblique, nearly vertical, ventro-caudal angle with a roundly subacute lobation.

Tegmina reaching as far caudad as the base of the ultimate tergite (supra-anal plate), elongate lanceolate, with the greatest width (which is at proximal and distal fifths) contained slightly more than seven and one-half times in the tegminal length, the whole slightly narrowed mesad, the distal extremity but faintly curving suturad; costal margin in large part straight, in distal fifth arcuate to the rather narrowly rounded apex, sutural margin very faintly sigmoid; venation sharply marked, mediastine vein reaching costal margin briefly proximad of middle of tegmen, areolations of discoidal field quite open, quadrate, rectangulate or more rarely heptagonal, those proximad usually rectangulate, the largest in the median forks; the single axillary vein reaches distad slightly more than a fourth of the tegminal length before coalescing with the sutural margin, areolation of anal field dense, involved and subreticulate immediately proximad, elsewhere quite open with areolae relatively large. Wings when closed but briefly failing to reach the tegminal apices, when expanded not reaching the tegminal apices by a distance equal to approximately half the pronotal length, greatest breadth of wing equal to slightly more than three-fifths of the length of the wing, the more distal peripheral marginal units of the

radiate field quite strongly arcuate individually, immediate apex of wing quite broadly rounded, little surpassing the adjacent section of the radiate field's periphery; discoidal vein with two spaced, generally straight rami, areolation of whole wing with large, generally regular units.

Interspace between the mesosternal lobes distinctly transverse, the meso-internal margins of the lobes strongly oblique, weakly arcuate: metasternal foraminal fossa large, strongly transverse, subtrigonal, the contained individual foramina narrowly elliptical, oblique in position, convergent cephalad.

Penultimate abdominal tergite narrowly and sharply fissate medio-longitudinally, narrowly so and this with sharply parallel borders in the type, but compression may have exaggerated this, antepenultimate tergite with margin medio-distad briefly subfissate, this continuing the penultimate incision, then more distad finely but definitely carinato-tectate: in lateral view the ventro-caudal extremities of the penultimate and antepenultimate tergites are acutely and equally produced ventrad of the cercal bases; ultimate tergite (supra-anal plate) lanceolate-acute, greatest median length one and one-half times the greatest proximal width, apex sharply acute, arcuately decurved, surface in proximal half with a pair of carinae converging proximad to the penultimate tergite's fission from the middle of the ultimate where they join the oblique distad converging lateral margins, these carinae each having an accessory carinula diverge from their middle proximo-laterad toward the lateral bases of the tergite, the intercarinal surfaces in all cases subexcavate;⁵⁰ infra-cercal plates reaching virtually to the apex of the ultimate tergite, acute, deeply excavate medio-longitudinally: cerci simple, evenly tapering, acute at apices, which fail to reach the tips of the infra-cercal plates; ovipositor valves very slender, particularly the ventral ones, moderately compressed, the ventral ones in profile but slightly sigmoid, teeth relatively small (when compared with those of *E. unca*), dorso-external ones 11 to 12 in number (excluding distal point), ventro-external series numbering 11 to 12 (also exclusive of distal point); ultimate sternite (subgenital plate) with its distal margin deeply V-emarginate on each side of a median moderately acute production, the lateral margins of which latter are faintly arcuate, the emarginations extending half way toward the base of the tergite from the rounded rectangulate lateral angles of the same, the subvertical lateral portions of the tergite bearing slightly dorsad of their longitudinal axis a longitudinal and rounded sulcation, which briefly fails to reach the subvertical caudal margin of this portion of the sternite.

Cephalic and median limbs essentially as in female of *E. unca* except for being slightly more slender. Caudal femora in length but slightly less than three-fourths that of the body (including ovipositor jaws), surpassing the apices of the ovipositor jaws by approximately the length of the pronotal disk; caudal tibiae with 23 external and 21 internal spines.

Coloration.—General base tone of abdomen and most of limbs light yellowish olive, the dorsum of the pronotum largely darkening to buffy olive, the pleura, thoracic venter, most of the lateral lobes of the pronotum, the genae, face, and caudal femoral annulus lightened to apricot yellow. Oc-

⁵⁰ It is impossible to tell how much of the emphasis of the carinae or the excavation of the intermediate areas seen in the unique type may be due to distortion in drying.

cupit and postocular area of head largely mummy brown, rather open and irregular but serially paired and caudad diverging vermiculations between the two sections washed with pale carmine, which by continuation colors the more dorsal section of the lateral carinae of the frontal costa; eyes snuff brown, indefinitely clouded with bister; antennae with two proximal articles mustard yellow, remainder bister. Pronotum with obscure continuations of the postocular bars approaching mummy brown, hardly delimited from the buffy olive dorsum of the prozona, dorsum of the metazona cribrosely marked with fuscous. Tegmina with venation pencilled with fuscous, membrane hardly at all tinted. Wings as tegmina except that the tinting of the membrane is even weaker, aside from that near the proximal section of the periphery, where a clouding about as on the tegmina is evident. Abdomen vermiculately infuscate in proximal portion, this becoming heavier and nearly solid distad, ovipositor paling in areas to light yellowish green, teeth fuscous tipped. Caudal femora with the carinae pencilled with fuscous black except where broken by the complete pregenicular pale annulus, the latter broadly bordered proximad and distad with fuscous which involves the whole apex; caudal tibiae and tarsi solidly infuscate, the spines black tipped.

Length of body, 23.1 mm.; length of pronotum, 3.26; length of tegmen, 13; length of caudal femur, 15.6.

The type of this very distinctive species is unique. The acquisition of further material is awaited with interest, particularly of the male sex, which may have genitalic features as characteristic as does the female.

Eumastacops nemorivaga⁶⁰ new species

Text-figures 52, 57, 58,
59, 60; pl. 2, figs. 13, 14, 15.

The present species holds a rather isolated position, and is not at all closely related to *E. trifida*, which here precedes it. From *militaris* it can readily be separated in both sexes by the longer, caudad more angulate pronotal disk, the less expanded and subspatulate distal portion of the tegmina, as well as by the greater number of tegminal areolations, the male cerci also not being recurved falcate, while the ovipositor valves of the female are more attenuate and the female ultimate sternite (subgenital plate) more elongate acute-produced with its convergent margins straight oblique. From *plebeja*, *nemorivaga* can at once be distinguished by the very distinctive fissate form of the ultimate sternite (subgenital plate) of the female in the former species, which is in no way approached in the present form, while in addition the whole form is more slender and sub-compressed and the tegminal venation more delicate than in *plebeja*. From both *parishi* and *caligo* the longer and broader tegmina and wings will at once distinguish *nemorivaga*, while the genital features of those two species are also distinctively different from what is found in *nemorivaga*. Probably

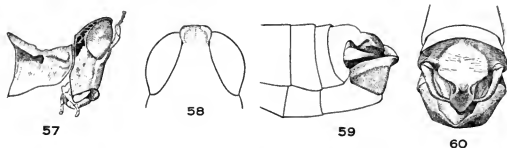
⁶⁰ I. e. *wandering through the woods*, in allusion to the forest conditions of its habitat.

nemorivaga as a whole is slightly nearer in relationship to *militaris* than it is to any other form now known, or at least which we have seen.

Type.—♂; Cavinass,⁶¹ Rio Beni, Bolivia. February, 1922. (Mulford Biological Expedition; W. M. Mann.) [United States National Museum.]

Size rather under the average for the genus; form quite slender.

Head rather strongly elevated dorsad of the level of pronotum, the occiput in profile arcuately ascending to the subhorizontal level of the fastigium; greatest width across genae equal to approximately seven-eighths that across the eyes;⁶² fastigium as seen from dorsum but slightly more than one-fifth the width across the eyes,⁶² its cephalic outline in this view low arcuate, the lateral borders also arcuate and projecting slightly over the contiguous part of the eye outline, the surface as a whole not excavate, the lateral borders subcarinate and spiralling cephalad to paired low mammillate nodes, in profile the fastigio-facial angle subrectangulate; frontal costa not definitely separated from the fastigial disk, at most only



Eumastacops nemorivaga new species. Male (*type*). Cavinass, Rio Beni, Bolivia. Fig. 57.—Lateral view of head and pronotum. Fig. 58.—Dorsal view of fastigium. Fig. 59.—Lateral view of apex of abdomen. Fig. 60.—Dorsal view of apex of abdomen. (All greatly enlarged.)

a slight transverse crease being present ventrad of the mammillate nodes,⁶³ lateral margins evenly convergent from the dorsal point to between the paired ocelli, where they are subcontiguous, whence ventrad they continue closely parallel to the median ocellus, which is closely encircled, and the carinate margins thence are sharply marked to the clypeal suture, very faintly diverging from ventrad of the ocellus, sulcus well impressed throughout; accessory facial carinae well marked, faintly diverging ventrad from the eyes; facial line in profile oblique ventrad of antennae, briefly arcuate for some distance dorsad and ventrad of the antennal bases; eyes prominent with their greatest depth equal to slightly more than one and one-third times the infra-ocular depth of the genae, basal outline of eye broad ovate, the greatest breadth equal to five-sevenths of the eye depth; antennae incomplete, proximal and second articles quite slender, the second equal to half the length of the proximal one.

⁶¹ A mission station five kilometers east of the Rio Beni, just below the junction of the Rio Beni and the Rio Madidi. Approximate position, 66° 48' W., 12° 33' S. Elevation under 200 meters.

⁶² This measurement is made from the paratypic male, as the eyes in the type are somewhat shrunk from drying after liquid immersion.

⁶³ The type shows a definite fold here, but this is clearly adventitious, and certainly due to desiccation.

Pronotum definitely selliform, its dorsal line in profile obtusely concave, as seen from dorsum the pronotum as a whole and also the disk alone appreciably broadened caudad, the greatest width across the lateral lobes caudad being subequal to the median length of the disk; cephalic margin of pronotal dorsum truncate, caudal margin markedly obtuse-angulate produced with the immediate angle narrowly truncate; median carina evident but low on the metazona, present but obsolescent on the prozona, yet not definitely severed by transverse sulci, median length of metazona, from the lateral indication of the transverse sulcus which is obsolete on the disk, equal to two-fifths of the pronotal length, surface of metazonal disk cribrosely impresso-punctate, lateral shoulders of disk rather deeply cut by the first and second transverse sulci, the principal (caudal) one much less definite; lateral lobes somewhat longitudinal, greatest length to caudal depth of lobes as 6 to 5, deepening caudad, cephalic margin subvertical dorsad, in ventral half broadly arcuate over the ventro-cephalic angle to the ventral margin, which is sinuately descending caudad to the briefly but definitely acute-produced ventro-caudal angle, caudal margin subvertical, shallowly concave.

Tegmina⁶⁴ very slightly surpassing the apices of the caudal femora, moderately spatulate distad, yet much less definitely so than in *E. militaris*, the breadth at distal fourth one and one-third times that at proximal fourth, the distal third of tegmen subfalcate in the moderate but definite recurvature of the distal third; costal margin nearly straight in proximal two-thirds, thence definitely arcuate to the rather broadly rounded apex, sutural margin very weakly concave in distal half, nearly straight thence proximad; venation very open, regular and simple in proximal two-thirds, in distal third with interspaces between principal veins or their rami in discoidal field chiefly biseriately celled except for the uniseriate medio-ulnar area. Wings in repose falling but slightly short of the tegminal apices, the apex of the anterior field broadly rounded, the individual sections of the radiate field each arcuately sublobate at the peripheral margin, venation open and regular.

Prosternum transverse, little elevated, with a subobsolete medio-transverse carinula; mesosternum with interspace very broad, equal to one and one-half times that of one of the lobes, internal margin of the lobes obliquely subtruncate; metasternum with lobes contiguous.

Abdomen carinate dorsad. Penultimate tergite with its dorsal emargination of the distal margin broadly concave, reached nearly to the cercal bases, filled with membrane which reaches to and connects with the broadly brace-shaped proximal margin of this portion of the ultimate tergite (supra-anal plate), lateral sigmoid arms of which enclose the membrane-filled area and reach to the internal side of the cercal bases, medio-distal linguiform portion of the ultimate tergite but little more than half as wide as the breadth across the basal arms of the tergite, acute lanceolate in shape, slightly narrower at its base than slightly distad of the same, its median length subequal to that of the membrane-filled area, in profile moderately declivent ventro-caudad; cerci elongate, in profile tapering, from dorsum seen to be subdeplanate, straight in proximal half, thence sharply inbowed, apices acute, aciculate, in

⁶⁴ Alar characters are taken in part from the paratypic male, as the tegmina and wings of the male were badly damaged before the specimen reached our hands.

profile not at all decurved; ultimate sternite (subgenital plate) broad, little produced, as a whole with margin transversely arcuate,⁶⁵ the chitinous portion of the sternite very shallow, in fact little more than a stiffening border, membranous portion at ventral base very extensive, occupying by far the greater portion of the sternite's depth, in profile the dorsal outline of the sternite is seen to be low arcuate; distal margin of penultimate sternite broadly arcuate.

Limbs elongate and slender, the cephalic femora approximately one and one-half times as long as the pronotal disk, the median slightly longer. Caudal femora ⁶⁶ surpassing the apex of the abdomen by slightly more than the combined dorsal length of the head and pronotum, greatest depth at proximal fourth contained nearly six and one-half times in the femoral length, carinae microcrenulate; caudal tibiae with 23-24 external and internal spines.

Allotype.—♀; Teffe, State of Amazonas, Brazil. December 12, 1919. (H. S. Parish.) [Hebard Collection.]

Differing from the above description of the male sex in the following noteworthy features.

Size larger than in male; form similar but slightly more robust.

Head with greatest width across genae equal to nineteen-twentieths of that across eyes; fastigium as seen from the dorsum equal to one-fourth the width of the head across the eyes, its cephalic margin as seen in same view more transversely truncate than in the male, its form and sculpture otherwise the same, the fastigio-facial angle in profile sharply rectangulate, more evident than in the male, probably on account of the less bullate eyes; frontal costa as in male except that the lateral margins are more arcuate divergent dorsad and the inter-ocellar convergence is not quite as marked; eyes less prominent than in male, yet more evident than in most females of the group, greatest depth equal to slightly more than one and one-half times the infra-ocular depth of the genae, basal outline of eye less broadly ovate than in male, the greatest breadth equal to but slightly more than half the length (as 22 to 39); antennae very short, but slightly longer than greatest depth of eye, two-fifths of the total length taken up by the two proximal articles, distal portion slightly depressed, distal article moderately acute.

Pronotum less strongly selliform than in male, its dorsal line in profile less decidedly concave, proportions and margins of disk as in male; median carina equally evident on the prozona and metazona, unsevered by transverse sulci; lateral lobes as in male.

Tegmina reaching to the apices of the caudal femora, spatulate distad as in the male, the breadth at distal fourth equal to one and two-thirds times that at proximal fourth, subfalcation of distal third of tegmen and margins as in male; venation as in male. Wings in repose reaching to the tegminal apices, in details as in male.

⁶⁵ The type, by the pull of drying from liquid preservative, shows a median obtuse-angulation, but the paratype shows this is not natural.

⁶⁶ The type lacks the caudal limbs, and these features have been drawn from the paratypic male. On the other hand the type has the abdominal appendages of the male in better condition than those of the paratypic male.

Ultimate abdominal tergite (supra-anal plate) elongate acute trigonal, its proximal median section with a deeply foveolate diamond-shaped impression, analogous in position and character to the membrane-filled area of the same tergite in the male, the more proximal acute angle of the diamond dividing the penultimate tergite to its evident base, the distal acute linguiform process of the ultimate tergite much as in male, the proximal diverging chitinous rami of the tergite essentially as in the male; infracercal plates reaching virtually to the apex of the ultimate tergite, rounded acute, at apex deeply longitudinally impressed; cerci styloform, tapering, acute, equal to two-thirds the length of the ultimate tergite; ovipositor valves of moderate depth but appreciably compressed, the ventral ones quite distinctly and evenly narrowing distad as seen from venter, teeth relatively robust, dorso-external ones nine to ten in number (excluding distal point) dorso-internal teeth six, ventro-external ones nine with several additional subobsolete proximal denticles; ultimate sternite (subgenital plate) elongate, its distal margin acute trigonal produced, the converging margins straight, entire, the second of the sternite included in the lanceolate structure being subequal in length to that of the more proximal portion.

Limbs much as in male, apices of the caudal femora falling slightly short of the tips of the ovipositor valves; greatest depth of caudal femora contained six and one-fifth times in the femoral length; caudal tibiae with spine numbers as in male.

*Coloration.*⁶⁷—Pale base color sulphine yellow in the male, between primuline yellow (Ridgway) and ochraceous-orange in the female, in the male the dorsum of the pronotum becoming raw sienna, in the female the same is light brownish olive. Head with face paling to light yellow ocher passing to pale grayish on the genae, limited pale areas on the occiput of similar tone; marked postocular bar and irregularly connected subparallel and paired bars on the occiput blackish fuscous, the dorsum of the fastigium largely of the same shade; eyes tawny-olive to dresden brown, blotched to variable degrees with blackish fuscous. Antennae with two proximal articles of the color of the face, thence distad progressively becoming solidly fuscous. Pronotum with postocular blackish fuscous bars continued solidly to the tegminal bases, lateral lobes ventrad of these bars and the pleura solidly of the pale base color. Tegmina with venation pencilled in fuscous, at times greenish fuscous, membrane lightly tinted with olive greenish. Wings as the tegmina except the membrane is almost clear hyaline. Abdomen with the tergites obscurely lined longitudinally with fuscous, these pencillings broken and of variable strength, four distal tergites in both sexes quite solidly blackish fuscous. Limbs as a whole of the general color, the tibiae passing to brownish olive, the blackish fuscous pencilling of the carinae of the caudal femora marked, the distal extremity of these femora washed with fuscous and two subobsolete preapical clouds of similar but weaker tone apparent on the dorsal and internal surfaces; caudal tibiae in the male with a weak pregenicular pale annulus hardly indicated in the female, tibial carinae weakly lined with fuscous.

⁶⁷ As the male type has been dried after immersion in a liquid preservative the color tone has been altered, although the pattern is unchanged. The color tones for the male therefore are drawn from the male paratype.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Cavinás, <i>type</i>	15.6	2.44	—	—
♂, Rio Purus, <i>paratype</i> ..	14.9	2.28	16.3	13.0
♀, Tefe, <i>allotype</i>	23.6	2.77	16.6	13.8

In addition to the type and allotype we have before us a single male from the collection of the Stockholm Museum, taken in February on the Rio Purus, State of Amazonas, Brazil, by Roman, which we are considering a paratype. While this specimen is otherwise complete, the apex of the abdomen has at some time been badly injured, so that its genitalic features are largely destroyed. These are better preserved in the Cavinás, Bolivia male selected as the type, although the latter individual has the apices of the tegmina and wings injured, its caudal limbs lacking and its coloration altered by drying from wet preservative. There is, however, no question of the specific identity of the two males, or of the female, which shares with the type the distinctive structure of the ultimate abdominal tergite (supra-anal plate).

From the available material it will be seen that *memorivaga* is found in at least the central part of the course of the Amazon, and thence follows the great Madeira tributary southward to one of its main affluents (the Rio Beni) in northern Bolivia.

***Eumastacops militaris* (Gerstaecker)**

Text-figure 53; pl. 2, figs. 9, 11.

1899. *Mastaz militaris* Gerstaecker, Mitth. Naturw. Ver. Neu-Vorpomm. und Rügen, Greifswald, XX, p. 42. [♂, ♀; Olivença (♂) and Fonteboa (♀), Amazonas, Brazil.]

We have before us the original male and female on which Gerstaecker based the species, of which we here select the male, from Olivença, as the single type, the Fonteboa female being considered the allotype. Both are in perfect condition except for the loss of part of the left antennae and a slight break in the left wing in the type. The latter has apparently retained its natural coloration, but the allotype, which bears a supplementary green label reading "♀. Fonteboa, Hahnel", has had its coloration injured, apparently by prior wet preservation or desiccation.

This species is readily separated from all other species of the genus of which the male is known by the sharply recurved and hooked cerci of the

male, while the relatively blunter and undivided ultimate sternite (subgenital plate) of the female is characteristic when more nearly related forms are considered. The more or less definite darker pencilling of the paginal pattern of both faces of the caudal femora is also peculiar to this species, and in no other species of the genus known to us are the tegmina in both sexes so broadly spatulate distad, definitely more so than in *memorivaga*, the nearest approach in this respect. On account of these features we are considering it the sole members of a distinct group, the *Militaris* Group.

The following descriptions are supplementary to the original one of Gerstaecker, which omits numerous features of systematic value.

Male (*type*); Olivença, State of Amazonas, Brazil. [Zoological Museum, University of Greifswald.]

Size large for genus; form relatively slender, moderately compressed.

Head in profile with occiput strongly arcuate ascendent to the subhorizontal level of the fastigium; greatest width of head across eyes slightly less than that across genae (as 53 to 56); width of fastigium as seen from the dorsum slightly more than one-fifth the width across the eyes (as 11 to 53), its outline as in *E. memorivaga* except that its cephalic border, as seen from dorsum, is weakly subconcave mesad and the internal side of its lateral margins more impressed, in profile the fastigio-facial angle is weakly obtuse, blunter and less pronounced than in *memorivaga*; frontal costa not definitely separated from the fastigial disk, its margins flaring rather strongly toward the fastigial passage, thence ventrad in spacing and character as in *memorivaga*; accessory facial carinae as in *memorivaga*; facial line in profile as in *memorivaga* but juxta-antennal convexity slightly more marked; eyes very slightly less prominent than in *memorivaga*, their greatest depth equal to one and one-quarter times the infra-ocular depth of the genae, basal outline of eye broad ovate, greatest breadth equal to seven-tenths of the eye depth; antennae incomplete, second article equal to half the length of the proximal one, both somewhat stouter than in *memorivaga*.

Pronotum as definitely selliform as in *memorivaga*, its dorsal line in profile rising less markedly cephalad, as seen from dorsum its general appearance is as in *memorivaga*, median length to greatest breadth across lobes subequal as in that species; cephalic margin of disk subtruncate, caudal margin evenly convex, no angle indicated; median carina thick and definite cephalad, obsolete caudad, not definitely severed by any transverse sulci, the metazona not clearly delimited from the prozona by any transverse impression or surface indentation, surface of metazonal disk finely rugulose on which is superimposed a definite transverse plicatulation of the surface most apparent mesad, lateral shoulders of disk less distinctly cut than in *memorivaga*; lateral lobes with caudal depth and dorsal length subequal, the depth decreasing cephalad, cephalic margin moderately arcuate, ventrocephalic angle rounded obtuse, ventral margin sinuate, caudal margin vertical and weakly concave, ventro-caudal angle rectangulate.

Tegmina surpassing the abdominal apex by slightly more than the length of the pronotum and but very slightly exceeding the apices of the caudal femora, markedly spatulate distad, the breadth at distal fourth slightly

more than one and two-fifths times that at proximal fourth, the subfalcation of the distal third, as a whole, much as in *E. nemorivaga*, margins as in latter species except that the apex is even more broadly rounded; venation as in *E. nemorivaga* except that the broader apex has a somewhat greater number of areolae in the discoidal field. Wings essentially as in *nemorivaga* except for a slightly larger number of areolae distad in the anterior field.

Sternal characters as in *E. nemorivaga*.

Abdomen carinate dorsad, most distinctly so proximad. Penultimate tergite with the median emargination of its distal margin shallowly biconcave, the more lateral portions of the margin, as seen from dorsum, obliquely subsinuate to the cercal bases about which this tergite is strongly concave encircling; ultimate tergite (supra-anal plate) divided into two elements by marked median constrictions of the lateral margins, the triangular emarginations of the latter reducing the width of the tergite between them to no more than half that of the more distal portion, proximal section subquadrate with lateral margins slightly diverging caudad and disto-lateral angles rounded, surface of proximal section moderately subpapillose with a distinct medio-longitudinal sulcation, narrowing distad, which becomes obsolete about the middle of the distal section of the tergite, which latter is sublinguiform, its distal margin weakly acute, the length faintly greater than the sectional width, its surface rugulose with the median sulcation as above; cerci strongly recurved mesad, proximal half strongly tapering from stout, subinflated bases to the middle, where a sharp incurve bends the narrow, definitely compressed distal portion meso-proximad, the acute apices directed toward the deepest point of the lateral emargination of the ultimate tergite (supra-anal plate), the most distal point of the bend falling short of the apex of the ultimate tergite; ultimate sternite (subgenital plate) strongly transverse, its dorso-distal margin but moderately arcuate as seen from the dorsum, the chitinous portion of the sternite occupying the dorsal third of its elevation as seen in caudal aspect, the membranous area in the same view seen to be transversely subacute elliptical, the depth approximately half the width, the chitinous dorsal section thus appreciably deeper laterad than mesad; penultimate sternite, as seen from venter, with its distal margin transverse.

Cephalic and median limbs similar to but less slender than those of the male of *E. nemorivaga*. Caudal femora much as in *nemorivaga* but slightly deeper, the depth at proximal fourth contained slightly under six times in their length, carinae similarly micro-crenulate; caudal tibiae with 23-25 external and 22-23 internal spines.

Allotype.—♀; Fonteboa, State of Amazonas, Brazil. (Hahnel.) [Zoological Museum, University of Greifswald.]

Differing from the above description of the male sex in the following noteworthy features.

Size larger than in male but otherwise, and in proportions, much the same in general features.

Head as in male except the width across the eyes, as seen in cephalic aspect, is slightly less than that across the genae (as 60 to 65), the eyes being a little less prominent; width of fastigium equal to one-fourth the

width of the head across the eyes (as 15 to 60), the cephalic margin of the fastigium almost transverse truncate with the lateral borders slightly projecting cephalad and the juxta-marginal portions of the surface less impressed, in profile the fastigio-facial angle is as in the male; face in profile with juxta-antennal convexity much less marked; eyes less prominent, with their greatest depth but slightly greater than the infra-ocular depth of the genae (as 45 to 43), greatest breadth of basal outline of eye equal to seven-tenths of the depth; antennae short, but very slightly exceeding dorsal length of head, weakly deplanate distad, apex acute.

Pronotum with sellate concavity of dorsal line slightly less strongly indicated than in male, as seen in profile, as a whole slightly stouter and transverse width across lateral lobes slightly greater than median length of disk; cephalic margin of disk truncate as in male, caudal margin arcuate with the intimation of a slight median obtuse-angulation; median carina indicated across the whole disk, thicker and higher cephalad, finer and lower caudad, but equally evident, poorly severed at cephalic fourth, but division of metazona from prozona no more evident on the disk than in the male, surface of metazonal disk ruguloso-cribrose, evidence of transverse plicatulations subobsolete and only mesad; lateral lobes with caudal depth slightly greater than dorsal length (as 8 to 7), margins and angles as in male except that the ventro-caudal angle is more blunted than in male.

Tegmina very slightly surpassing the apices of the abdomen and of the caudal femora, distal spatulation as in the male but slightly less pronounced proportionately, the breadth at distal fourth being slightly less than one and two-fifths times that at proximal fourth, subfalcation of distal third, shape of the margins and the venation as in male. Wings as in male except that the marginal arcuations of the individual units of the radiate field are less strongly bowed, i. e., slightly flatter.

Ultimate tergite (supra-anal plate) with its proximal half having the surface V-impression mesad with its greatest depth at a median sulcation,⁶⁸ bounding which area laterad are subparallel carinae, these framing dorsad and distad subvertical rectangulate portions of the tergite, distal half slightly longer than the proximal, acute sublinguiform, with a proximal V-shaped impressed area, the longitudinal axis moderately decurving thence distad; cerci conical, stout at base, immediate apex subaciculate, reaching to middle of distal half of ultimate tergite; ovipositor valves moderately compressed, the dorsal pair as seen from the dorsum of the same subsigmoid outline as in the female of *E. nemorivaga*, ventral valves as seen from venter less evenly narrowing distad than in *nemorivaga*, the section between the extremity of the proximo-ventral plate and the distal tooth on the external margin subequal in width, the surface of this same area more concavely excavate than in *nemorivaga*, form of valves in profile very similar to that of *nemorivaga*, dorso-external teeth ten in number (excluding distal point), dorso-internal teeth consisting of three to four marked ones and several more proximal and distal subobsolete denticles, ventro-external ones seven to eight in number proximad to the apex of the proximo-ventral plate; ultimate sternite (subgenital plate) with its distal margin obtuse-angulate, the lateral portions of the margin moderately arcuate to the distal point.

⁶⁸ How much of this contour and the emphasis of the accompanying carinae is due to drying cannot be determined from the single female.

Cephalic and median femora slightly less slender than in male; greatest depth of caudal femora (at proximal fourth) contained five and one-third times in the femoral length; caudal tibiae with 22-25 external and 22-24 internal spines.

Coloration.—Pale base color in male light cadmium yellow (Ridgway), in female (altered?) wax yellow to honey yellow, in the latter with the face washed strongly with cinnamon-rufous, the genae, lateral lobes of the pronotum and pleura less deeply tinted with ochraceous-tawny; in the male a pair of postocular bars of fuscous, with a greenish tinge on the head, extend from the eyes across the dorsum of the pronotum, occupying almost all of the pronotal dorsum, leaving cephalad only a sharply defined narrow median carinal pale bar, while caudad the internal margins of the postocular bars are indefinite and the paler center area is broader and blends into the darker paired sections, in the female these areas are much lighter and less sharply defined, their color weak olive-green; antennae with two proximal articles of pale base color thence becoming fuscous; eyes deep mars brown (male) to snuff brown (female). Tegmina with venation pencilled in fuscous to olive-green, the membrane slightly tinted with olivaceous; wings similar to tegmina but the pencilling of the veins more definitely fuscous in both sexes. Abdomen in male largely pale, in proximal half with detached elements of two incomplete longitudinal lateral bars on each side, these olivaceous; ultimate tergite, cerci and disto-ventral portions of the penultimate and antepenultimate tergites, as well as a broad dorsal saddle involving the two preceding tergites brownish fuscous, the collar with a reddish tendency; on female largely of the dull general color, the ultimate tergite with its distal portion and the median area of the proximal portion fuscous. Limbs of the pale base color, the caudal femora with the carinae (except the two ventral ones) very conspicuously lined with fuscous-black, the pattern of the pagina, both external and internal, appreciably lined with olive-green, more conspicuously so in the female than in the male, the femora as seen in dorsal and lateral aspect show two incomplete cloud annuli of fuscous in their distal halves; caudal tibiae in male clear gray, the spines largely blackish, caudal tarsi greenish gray; caudal tibiae in female nearer the pale general color, spines largely blackish.

♂: Length of body, 16.6 mm.; length of pronotum, 2.5; length of tegmen, 17.9; length of caudal femur, 13.5.

♀: Length of body, 27.7 mm.; length of pronotum, 2.9; length of tegmen, 20.4; length of caudal femur, 15.8.

Gerstaecker's original material, the type and allotype, is all we have seen of this quite distinctive species. Burr⁶⁹ recorded material of it from the upper Amazon in the Brunner, Bolivar and Burr collections. Whether these individuals really are *militaris* remains to be determined, as the tegminal measurements do not agree with Gerstaecker's material. Apparently the species has a restricted range in Brazilian Amazonia.

Eumastacops versicolor (Burr)

1899. *Eumastaz versicolor* Burr, Anales Soc. Españ. Hist. Nat., XXVIII, pp. 258, 269. [♀; Paraguay.]

⁶⁹ Anales Soc. Españ. Hist. Nat., XXVIII p. 267, (1899).

The reference of this species to *Eumastacops* is purely provisional. The species clearly cannot be referred to *Eumastax*, *Pseudomastax* or *Paramastax*, as shown by the description of the fastigium, while the hyaline tegmina and wings, combined with the positive fastigial features would point to *Eumastacops*. If the present generic reference is found to be correct, when material of the species is available for study, the distribution of the genus is much more extensive to the southward than the present available collections would indicate.

Eumastacops plebeja (Gerstaecker)

Text-figure 54; pl. 1, fig. 6.

1899. *Mastax plebeja* Gerstaecker, Mitth. Naturw. Ver. Neu-Vorpomm. und Rügen, Greifswald, XX, p. 47. [♀; Fonteboa, Amazonas, Brazil.]

The unique type of *plebeja* is now before me, through the courtesy of the authorities of the Museum of the University of Greifswald. It is perfect except for the right cephalic tarsus, although, apparently through immersion at some time in a wet preservative, the more delicate color tones have been destroyed. The very distinctive feature of the species is the briefly fissate ultimate sternite (subgenital plate) of the female. Whether the male sex will be found to possess genitalic features as distinctive as those of the female remains to be determined. We have seen no material other than the unique type.

Burr in his key to the species of the genus *Eumastax*⁷⁰ erred in including this species in couplet 1, as it should have gone in 1.1, along with *militaris*, to which it is not distantly related. Aside from the fissate ultimate sternite the female sex of *plebeja* can be separated from that of *militaris* by the less prominent eyes, longer and less strongly sellate pronotum, which also is less strongly carinate mesad, arcuate caudal margin of disk of same, by the longer lateral lobes of pronotum with more distinctly acute-produced ventro-caudal angle, more slender, shorter, and shallower and more finely dentate ovipositor jaws, narrower and more subequally wide tegmina, more sub-cycloid wings with anterior field of same narrower, and fewer areolae near apex while axillary vein is less divergent from anal vein, as well as by details of the coloration, such as the non-lineate paginal pattern of the caudal femora.

When compared with *E. parishi*, here described, *plebeja* is seen to have the pronotum longer with its lateral lobes more distinctly longitudinal, the eyes less prominent (in the female), the caudal margin of the pronotal disk less arcuate, the ovipositor valves more slender and evenly tapering with more numerous and smaller teeth and slightly more robust cephalic and median femora, in addition to the basic difference in the shape of the ultimate sternite (subgenital plate) of the female sex. It is clear that *plebeja*

⁷⁰ Ann. Soc. Españ. Hist. Nat., XXVIII, pp. 257-258, (1899).

is more closely related to *parishi* than it is to *militaris*, and we have associated the first-mentioned two in the same group—the Parish Group.

The following detailed description should prove of service in the recognition of the species.

Female (*type*); Fonteboa, State of Amazonas, Brazil. [Zoological Museum, University of Greifswald.]

Size medium (for genus); general form much resembling that of the same sex of *E. militaris*.

Head with line of occiput as seen in profile ascending as strongly as in the female of *E. militaris* but in a flatter arcuation, level of fastigium sub-horizontal; greatest width of head across eyes very slightly less than that across ventral portion of genae (as 60 to 63); width of fastigium, as seen from dorsum, slightly less than a fourth the width across the eyes (as 14 to 60), its outline essentially as in the female of *militaris* except that the cephalic border is more definitely concave, in profile the fastigio-facial angle is more prominent than in *militaris*, definitely rectangulate; frontal costa dorsad of the paired ocelli as in *militaris*, but ventrad of same very much narrower, the margins virtually in contact for a distance ventrad of the median ocellus, which latter instead of being circular as in *militaris* is elongate very acute elliptical; accessory facial carinae as in *memorivaga* and *militaris*; facial line in profile with face itself flatter oblique; eyes somewhat less prominent than in *militaris*, their greatest depth equal to one and one-third times the infra-ocular depth of the genae, basal outline of eye as in female of *militaris*, the greatest breadth equal to two-thirds of the eye depth; antennae relatively short, although slightly longer than in female of *militaris*, subequal to length of pronotal dorsum, second article half the length of the first, the latter equal in this dimension to half the width of the eye outline, distal extremity of antennae weakly deplanate, apex moderately acute.

Pronotum rather elongate selliform, more longitudinal than in either *E. militaris* or *parishi*, in profile the dorsal line is evenly but not markedly concave, the bottom of the curvature mesad, median length of disk one and one-twelfth times the greatest breadth across the lateral lobes of the pronotum; cephalic margin of disk truncate, caudal margin of same not at all produced and but very weakly arcuate; median carina distinct, continuous, unsevered, somewhat more slender than in *E. militaris*, metazona not clearly delimited from the prozona by transverse impressions, surface of metazonal or caudal fourth of pronotal discal surface weakly cribroso-rugulose; lateral lobes definitely longitudinal, greatest dorsal length virtually equal to one and one-third times the greatest caudal depth of the lobes, the depth decreasing cephalad, cephalic margin vertical dorsad thence broadly arcuate across the ventro-cephalic angle to the subsinuate ventral margin, caudal margin vertical and weakly concave, ventro-caudal angle faintly sharper than a right angle.

Tegmina reaching to the apices of the ovipositor valves, falling appreciably short of the apices of the caudal femora, narrower and much less spatulate than in *E. militaris*, and even than of *E. memorivaga*, width at distal fourth but one and one-sixth times that at proximal fourth, distal

extremity but inconspicuously subfalcate; costal and sutural margins roughly subparallel, the apex well rounded; venation simpler than in *militaris*, more direct, straighter, branchings more compressed, less open, areolae much smaller than in *militaris*. Wings shorter, less attenuate and proportionately broader than in *militaris*, the greatest breadth across a single wing being equal to thirteen-twentieths of the greatest length of the wing; venation much as in *E. militaris* but areolation simpler toward the periphery, individual lobation of the various units of the radiate field more marked and distinctly arcuate.

Sternal characters as in *E. nemorivaga* and *militaris*.

Ultimate abdominal tergite (supra-anal plate) with its general development as in the female of *militaris*, the medio-longitudinal depression of the proximal half with its bottom flat, the laterad bordering lines, which mark the ventral border of ascending mesad-directed faces, convex toward the median line and thus appreciably diverging caudad, paired raised ridges on the tergite definitely outbowed, distal portion of ultimate tergite elongate trigonal in outline, slightly sharper toward apex than in *militaris*, medio-proximal V-shaped impression very pronounced, its surface level subcontinuous with that of the median impression of the proximal half of the tergite, distad converging borders of this area much more emphasized than in *militaris*, apex gently decurving; cerci reaching to middle of distal half of ultimate tergite, tapering, similar to but less robust than those of *E. militaris*; ovipositor valves much more slender than in *militaris*, even than in *nemorivaga*, in profile with the apices of both pairs of valves less recurved, as seen from the dorsum the dorsal valves are definitely straighter than in either *militaris* or *nemorivaga*, ventral valves as seen from venter evenly tapering distad, all marginal teeth proportionately small, dorso-external ones 12 to 15 in number (exclusive of distal point), the more proximal merely denticles, dorso-internal series merely 14 to 15 denticles, ventro-external teeth 11 in number, a short ventro-internal series of fine denticles also present; ultimate sternite (subgenital plate) moderately broad, its distal margin with lateral, distad converging, oblique, subsinuate sections meeting at a broadly rounded apex, which is fissately divided by a reversed V-shaped incision, this outlining a median narrowly trigonal section, which, however, does not quite extend caudad to the line of the broad apical curvature, the paired incision reaching proximad about one-sixth of the exposed ventral length of the sternite.

Limbs as a whole as in the female of *militaris*; caudal tibiae with 23 to 24 external and 22 to 24 internal spines.

*Coloration.*⁷¹—General tone sudan brown, paling to mars yellow on the limbs, to buckthorn brown on the abdomen, the face and adjacent part of genae cinnamon-rufous. No evident post-ocular dark bars. Tegmina with the membrane tinted with buffy citrine, the veins pencilled in dresden brown. Wings clear hyaline, venation fuscous. Ovipositor jaws and adjacent areas brownish olive. Caudal femora with carinae, except the two ventral ones, similarly but more weakly pencilled with blackish fuscous than in *militaris*, paginal pattern not tinted, caudal tibiae tinted with greenish gray, traces

⁷¹ This unquestionably has been seriously altered in tonal values by immersion in wet preservative of some character. The present description, however, is of the coloration of the unique type as it now appears.

of a pale premedian irregular and incomplete annulus. Antennae fuscous distad of the third article. Eyes decolored.

Length of body, 24 mm.; length of pronotum, 3.6; length of tegmen, 16.1; length of caudal femur, 17.1.

The type is the only specimen of this species which we have seen, or which has been reported.

Eumastacops parishi ⁷² new species

Text-figure 55; pl. 1, fig. 7; pl. 2, fig. 12.

This species is more nearly related to the preceding species, i. e., *plebeja* Gerstaecker, and to *caligo*, which follows *parishi* in this paper, than it is to any others. The narrower tegmina will at once separate it from both *nemorivaga* and *militaris*, the different female genitalia from *trifida*. From *plebeja* this species can at once be separated by the undivided margin of the ultimate sternite (subgenital plate) of the female, the simpler ultimate tergite (supra-anal plate) of the same sex, the generally uniseriate areolation of the tegmina, the rather shorter alar organs, the shorter pronotum, the more slender cephalic and median limbs and the less attenuate caudal femora. From *caligo* one can readily separate *parishi* by the less produced distal margin of the ultimate tergite (subgenital plate) of the female, the less marked angulation of the caudal margin of the pronotal disk of the same sex, the fuller arcuation of the ventro-cephalic angle of the lateral lobes of the pronotum and the somewhat shorter and less attenuate caudal femora.

Type.—♀; Kartabo, British Guiana. November 15, 1920. (William Beebe.) [Academy of Natural Sciences of Philadelphia, Type no. 5588.]

Size medium (for the genus); form somewhat more slender than in *plebeja*, which, however, it resembles in general features.

Head with line of occiput as seen in profile as full arcuate ascendant as in the female of *E. militaris*, level of fastigium subhorizontal; greatest width of head across eyes subequal to greatest breadth of genae; greatest width of fastigium contained four and two-fifths times in the greatest width across the eyes (as 12 to 65), its outline strongly suggesting that of *E. militaris* but with its latero-cephalic points more broadly rounded and its narrow cephalic margin more transverse and hardly excavate at all, internal border of lateral subcarinate margins subexcavate, the distal submammiiform nodes of the same well marked, in profile the fastigio-facial angle is as in *E. plebeja*, sharper than in *militaris*; frontal costa much as in *militaris* but median ocellus is less circular than in that species and more elongate as in *plebeja*; accessory facial carinae straighter and more subparallel than in either *militaris* or *plebeja*; facial line in profile nearly straight oblique ventrad of the antennae; eyes more prominent than in *plebeja*, broad ovoid in basal outline thus essentially as in *militaris* in this respect, their greatest depth equal to one and one-half times the infra-ocular depth of the genae (as

⁷² In recognition of the Amazonian and Guianan field investigations of Mr. H. S. Parish, the well-known Canadian entomologist, who collected material of four of the five new species of *Eumastacops* here described.

45 to 29), the greatest breadth of the eye outline equal to slightly more than thirteen-twentieths of the eye depth (as 29 to 45); antennae hardly longer than in *militaris*, subequal in length to pronotal dorsum, the length of the second article contained two and one-half times in that of the proximal article, distal article appreciably broadened, apex obliquely acute.

Pronotum relatively short and broad, appreciably selliform, the dorsal line in lateral aspect evenly concave, median length of disk contained one and two-fifths times in the greatest width across the lateral lobes of the pronotum; cephalic margin of pronotal disk subtruncate, caudal margin of same very broad and low obtuse-angulate; median carina of disk narrowly failing to reach the cephalic margin but otherwise conspicuously carinate and entire, metazona of disk differentiated from prozona of same only by surface sculpture, that of the metazona of both dorsum and lobes being irregularly cribroso-rugulose, more pronounced than in either *E. militaris* or *plebeja*; lateral lobes with greatest caudal depth but slightly greater than their dorsal length (as 40 to 44), as usual the depth decreasing cephalad, cephalic margin briefly straight subvertical in dorsal half, thence broad arcuate over the ventro-cephalic angle to the ventral margin, which is weakly sigmoid to the ventro-caudal angle which is blunted rectangulate, caudal margin straight and vertical.

Tegmina falling short of the apices of the ovipositor valves by one and one-half times the length of the pronotal disk and the apices of the caudal femora by slightly more, relatively narrow, in their general outline and proportions more as in *E. plebeja* than in *nemorivaga* or *militaris*, distal spatulation very slight, the width at distal fourth one and one-fourth times that at proximal fourth, appearing subfalcate only through the fuller costal side of the distal (apical) arcuation, margins otherwise much as in related species; venation very simple, areolation usually uniseriate subquadrate or rectangulate cells, generally more complex only near apical margin. Wings shorter, broader and more cycloidal than in *nemorivaga* or *militaris*, with proportions much as in *plebeja*, the greatest breadth slightly greater than three-fifths of the alar length, peripheral lobation of individual sectors slightly more arcuate than in *plebeja*; venation very simple, the areolation even much less involved than in *plebeja* and almost never more than irregularly biseriate and this only peripherally, in general uniseriate.

Sternal characters as in *E. militaris*.

Ultimate abdominal tergite (supra-anal plate) lanceolate, not sharply and clearly divided into two sections by a transverse incision, a marked and broad, but distad narrowing by sinuate borders, and distad shallowing median impression extends from the base to near the apex of the tergite, its proximal portion evident through the median V-shaped division of the penultimate tergite, lateral sections of ultimate tergite relatively narrow, vertical or in fact with their vertical planes slightly diverging dorsad to the margining carinae, the broad and elongate infra-cercal plates closely apposed to these surfaces, the plates reaching to the apex of the ultimate tergite, which is subacute with its surface non-sulcate and slightly decurving; cerci similar to but slightly stouter throughout than in *plebeja* and *militaris*, apex acute but not aciculate; ovipositor valves definitely stouter and more robust than in *plebeja*, but not as much so as in *militaris*, their profile, however, very similar to that of the latter species, marginal teeth larger than in

plebeja, similar in character to but slightly smaller than those of *militaris*, dorso-external ones (exclusive of distal point) seven to eight in number, dorso-internal series four to five with a few more proximal obsolete denticles, ventro-external teeth six to seven in number, a marked ventro-internal tooth and a few obsolete denticles also present; ultimate sternite (subgenital plate) with distal margin having each lateral section sigmoidally convergent to a median point which is faintly acute-angulate, this distal angulate portion occupying between a fourth and a fifth of the length of the sternite proximad to the lateral bases of the distal margin.

Limbs as a whole somewhat shorter in proportion than in the female of either *militaris* or *plebeja*, the greatest depth of the caudal femora contained five and two-fifths times in the greatest length of the same; external margin of caudal tibiae with 22 spines, internal with 24.

Coloration.—Pale base color olive-ocher,⁷³ lightening to deep colonial buff on the face and pale postocular areas. Head with occiput and much of postocular area ranging from quite solidly infuscate (type and Bartica paratype) to longitudinally lineate with six paired moderately infuscate lines, the narrow median pale line chamois, the others definitely grayish, the central four dark lines converging to the fastigium, the outer pair short and postocular in position, an obscure infuscate clouding of the infra-ocular portion of the genae also intimated in all; juxta-fastigial section of the frontal costa marked with shining fuscous, particularly laterad; face pale, unmarked, clypeus and labrum ecru-olive; antennae with the two proximal articles of the color of the face, thence becoming solidly fuscous; eyes dresden brown to cinnamon-brown, mottled with blackish fuscous. Pronotum, sterna and pleura pale, unmarked. Abdomen pale with obscure lateral longitudinal fuscous bilineations, which vary in evidence and completeness individually, most of terminal appendages suffused with fuscous, ovipositor valves washed with ecru-olive to buffy olive, the marginal teeth fuscous. Tegmina tinted with dark olive-buff, the veins pencilled with brownish olive. Wings almost clear hyaline, the venation pencilled as on the tegmina. Cephalic and median limbs of the pale base color, some of the carinae incompletely lineate with weak fuscous, the tarsi tending toward dull citrine. Caudal femora with all its carinae except the ventro-internal one lineate with blackish fuscous, the external pale paginal area as a whole or at least ventrad with a wash of flesh-ocher (Ridgway), this varying in extent and emphasis, indications of three incomplete transverse cloud annuli of fuscous can be noticed on the distal two-fifths of the caudal femora, one of which is definitely genicular and involves the whole of that area; caudal tibiae purplish brown with apex greenish, spines blackish, tarsi dull citrine.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♀, Kartabo, B. G. (<i>type</i>)	22.0	2.32	12.9	13.8
♀, Bartica, B. G. (<i>paratype</i>)	23.4	2.77	13.8	15.0
♀, Oriximina, Brazil (<i>paratype</i>) . .	24.4	2.68	14.5	16.4

⁷³ The type and the Bartica paratype are slightly stained from drying changes and are somewhat darker than the Oriximina individual, which clearly has the natural color tone.

In addition to the type we have before us two paratypic females of this species, one taken at Bartica, British Guiana, November 26, 1913, by H. S. Parish, and the other from Oriximina, on the Trombetas River, State of Pará, Brazil, taken September 2, 1919, also by Parish. Both of these specimens are in the collection of the Academy.

The species is closely related to *E. caligo*, described on a following page, and may be a complementary form in an adjacent area. Whether *parishi* reaches the Pará section of the Amazon we do not know, but its distribution as at present known affords further evidence of the identity of certain of the elements of the lowland faunas of British Guiana and of central or lower central Amazonia. The discovery of the male of *parishi* is awaited with interest.

Eumastacops caligo ⁷⁴ new species

Text-figure 56; pl. 1, fig. 8; pl. 2, fig. 10.

This species is more nearly related to the preceding one—*E. parishi* than any other, and we have already given under that species the more striking differential features, which it is not necessary to repeat. The divided character of the male cerci is quite different from what is found in any other species of which the male is known, while the ultimate sternite (subgenital plate) of the female has its greatest analog in that of *nemorivaga*, which can at once be separated by numerous features, such as the subspatulate tegmina and longer, narrower wings.

Type.—♂; Tefé, State of Amazonas, Brazil. December 2, 1919. (H. S. Parish.) [Hebard Collection, Type no. 1338.]

Size medium; form in general much as in *E. parishi*.

Head with greatest width across eyes but slightly greater than that across the broadest portion of genae (as 50 to 46), occipital outline as seen in profile strongly and broadly arcuate ascendant; fastigium as seen from dorsum relatively narrow, its width contained five and one-half times in that across eyes (9 to 50), its outline in same view rounded, the lateral borders broadly passing into the median, narrowly and obscurely subtruncate cephalic margin, dorsal surface of fastigium slightly tumid, the usual paired mammillate nodes well indicated and well separated yet not merging with the lateral margins; fastigio-facial angle in profile obtuse; frontal costa sulcate throughout, lateral margins narrowly but distinctly separated and subparallel from the median ocellus to one-third the distance from the paired ocelli to the fastigium, thence dorsad slightly diverging and with the sulcation becoming obsolete at the fastigial juncture, ventrad of the median ocellus the costal margins are more widely separated, subparallel and the sulcation is broader and shallower; supplementary (lateral) facial carinae subarcuate dorsad, straight parallel ventrad; facial line in profile weakly convex, this more evident between antennal bases than elsewhere; eyes moderately prominent, broad ovate in basal outline, their greatest depth almost equalling one and three-fifths times the least infra-ocular depth of

⁷⁴ I. e. *gloom*, in allusion to the shade of tropical forests.

the genae (as 38 to 24), the greatest width of the eye outline slightly less than three-fourths the greatest eye depth (as 28 to 38); antennae incomplete, second article slightly longer than half the proximal one (as 8 to 15).

Pronotum moderately selliform, dorsal line very markedly concave; median length of disk contained one and three-tenths times in the greatest width across the ventral portion of the lateral lobes of the pronotum (as 39 to 51); cephalic margin of disk truncate, caudal margin arcuato-obtuse-angulate; median carina well marked, entire and undivided, metazona separable from prozona on disk only by surface texture, the former moderately cribroso-rugulose, with a definite transverse disposition to the striatulae, which are marked as plicatulae on the median carina; lateral lobes moderately longitudinal, greatest dorsal length almost one and one-third times the greatest caudal depth of the lobe, the latter narrowing cephalad as usual in the genus, cephalic margin weakly arcuate, ventro-cephalic angle narrowly rounded obtuse, ventral margin weakly sinuate, ventro-caudal angle rounded subacute, caudal margin nearly straight vertical.

Tegmina surpassing the apex of the abdomen by approximately one and one-half times the length of the pronotal disk, falling short of the apices of the caudal femora by slightly more than the length of the pronotal disk, distal spatulation slight, width at distal fifth equal to one and nine-twentieths times that at distal fourth (as 36 to 25), margins as in *parishi* except that the apical one is more broadly and evenly arcuate, the curvature on the costal side more nearly subequal to that on the sutural side; venation essentially as in *parishi*. Wings of essentially the same proportions, shape and venation as in *parishi*.

Penultimate abdominal tergite strongly transverse, its distal margin broadly and sharply arcuate-emarginate mesad; ultimate tergite (supranal plate) elongate trigonal,⁷⁵ its surface transversely concave proximad, the median area thence distad subdeplanate, narrow marginal lateral areas in the proximal two-thirds subvertical, bounded dorsad by definite but low paralleling carinae similar to those seen in the males of other species of the genus, these becoming subobsolete mesad, distal portion of tergite moderately decurving at apex; cerci slightly surpassing apex of ultimate tergite, straight, quite stout, apex divided into two short acute spiniform points, one dorsad of the other, external surface subconcave between; infra-cercal plates reaching to the apices of the cerci; ultimate sternite (subgenital plate) transverse, little produced caudad, its chitinous portion restricted to a narrow dorsal margin, broadening laterad, the membranous proximo-ventral section occupying over four-fifths of the depth of the sternite, in profile the chitinous rim is seen to decurve meso-caudad, in dorsal aspect the same margin is seen to be very obtuse-angulate mesad; penultimate sternite with the lateral portions of its distal margin arcuate, mesad the same is not clearly defined from the membrane of the ultimate sternite.

Cephalic and median limbs somewhat more elongate and slender than in *E. parishi*. Caudal femora similarly somewhat more attenuate, the depth at proximal fourth contained five and seventeen-twentieths times in length of same; caudal tibiae with external spines exceptionally short, those of both margins 24 in number.

⁷⁵ This tergite is somewhat distorted by folding in the single male (type) seen. In consequence the description of it is a verbal reconstruction.

Allotype.—♀; Rio Autaz, State of Amazonas, Brazil. January. (Roman.) [Royal Swedish Natural History Museum.]

Differing from the description of the male sex (type) in the following noteworthy features.

Size, as usual, larger, but preserving essentially the same ratio of proportions.

Head with greatest width across eyes subequal to that across genae; fastigium as seen from dorsum broader, its width contained but four and one-half times in that of the head across eyes (as 12 to 54), definitely more transverse, its cephalic margin rounding laterad but transverse truncate mesad, surface less tumid than in male, the mammillate nodes distinctly smaller but equally evident, more cephalad in position, fastigio-facial angle in lateral view subrectangulate; frontal costa as in male but narrowest portion slightly wider in proportion and the difference in the breadth of that section and that of the portion ventrad of the median ocellus is less marked; facial line ventrad of antennal base slightly more straight oblique in profile than in male; eyes less prominent than in male but more protuberant than in the females of certain of the other species of the genus, proportions as in male; antennae very short, their length less than the depth of the face, slightly expanded and deplanate in distal half, apex bluntly acute.

Pronotum in general features as in male, its greatest width across ventral portion of lateral lobes one and one-eighth times the greatest median length of the disk (as 59 to 52); caudal margin of disk more definitely obtuse-angulate to immediate angle, not at all arcuate; lateral lobes with greatest caudal depth contained slightly less than one and one-quarter times in greatest dorsal length of the same, margins as in male.

Tegmina when in repose with their apices reaching caudad to middle of dorsal ovipositor valves, falling short of the apices of the caudal femora by slightly less than the length of the pronotal disk; proportions, shape and venation as described for male. Wings as in male, but peripheral individual areal margin arcuations slightly more flattened.

Penultimate abdominal tergite with medio-dorsal area truncate proximad and with caudad diverging oblique cariniform bounding margins, its surface obliquely declivent to a median obtuse-angulate impression, and with its caudal border arcuately segregated from the more lateral portions of the distal margin of the tergite and fusing with and inseparable from the ultimate tergite (supra-anal plate), which latter is elongate trigonal in shape, its apex rounded, subacute, weakly decurving in profile, its surface proximad broadly trigonal subimpressed, its proximo-lateral sections subvertical as in related species, the intervening ridge at most but subcarinate; infra-cereal plates reaching to the apex of the ultimate tergite; cerci styliiform, tapering, rather stout proximad, apex moderately acute, falling short of that of ultimate tergite, from dorsum the cerci are seen to be slightly outcurved; ovipositor valves in build, proportions and curvature as in *E. parishii*, series of dorso-external teeth reaching virtually to base of valves, those there quite small, total 14 to 15 in number (exclusive of distal point), dorso-internal margin with nine teeth, dorsal surface with a definite medio-longitudinal series of three teeth, ventro-external margin with eight to nine teeth, ventro-

internal margin with one pronounced median tooth and a few less evident proximad and distad; ultimate sternite (subgenital plate) with distal margin acute-angulate produced, the immediate angle sharp and not at all rounded.

Limbs as in male sex, caudal tibiae with spines ranging from 24 to 25.

Coloration.—General pattern resembling in certain respects that of *E. parishi*. Pale base color dull primuline yellow,⁷⁶ lightening on the head to naples yellow. Head with a medio-occipital and a pair of postocular bars of blackish fuscous, these very narrowly separated in the male by inter-spaces of grayish ochraceous, the spacings broader in the female, additional infra-ocular blackish fuscous bars cross the genae obliquely from the ventral border of the eyes toward the ventro-caudal angle of the genae, in the male in contact with the eye but not reaching the genal border, in the female not contacting either, lower face with a transverse subtrapezoidal area of blackish fuscous bounded laterad by the lateral facial carinae and ventrad, except in middle, by the bordering portion of the face, this area relatively solid in tone in the male, in the female represented only by cloud intimations, facio-clypeal suture area infuscate, as well as median section of clypeus and the entire labrum except for a pale border; antennae pale proximad, infuscate distad of fifth article; eyes dresden brown (male) to liver brown (female). Pronotum with area of median carina more or less completely barred longitudinally with fuscous. Abdomen with more proximal tergites laterad incompletely and irregularly trilineate with fuscous, this followed by a virtually clear pale annular saddle involving one (female) or two (male) tergites; dorsum of abdominal apex involving four tergites fuscous, paling distad to liver brown, which is the color of the cerci, ventral surface of the apex of the male abdomen infuscate, paling proximad; female with ovipositor valves, most of ultimate sternite (subgenital plate) and eighth tergite infuscate, remaining distal tergites russet. Tegmina with membrane weakly washed with olive-ocher, the veins pencilled with olive-citrine to dresden brown except proximad in the discoidal and anal fields when they pale to antimony yellow; immediate base of the marginal field as well as dorsal border of the pleura washed with fuscous. Wings clear hyaline, the veins pencilled in olive-brown. Cephalic and median limbs more or less washed with fuscous distad; caudal femora with carinae, except for ventral pair, lined with blackish fuscous, caudal tibiae and tarsi olive-brown, spines blackish fuscous.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur
♂, Teffe, type	14.6	2.11	12.7	13.2
♀, Rio Autaz, allotype ...	21.0	2.68	14.1	14.6

The type and allotype are all we have seen of this striking species, the facial pattern of which suggests certain species of *Pseudomastax*.

⁷⁶The allotype has had the tone of most of its coloring injured by drying, and it is in consequence of little value in describing color except for pattern features.

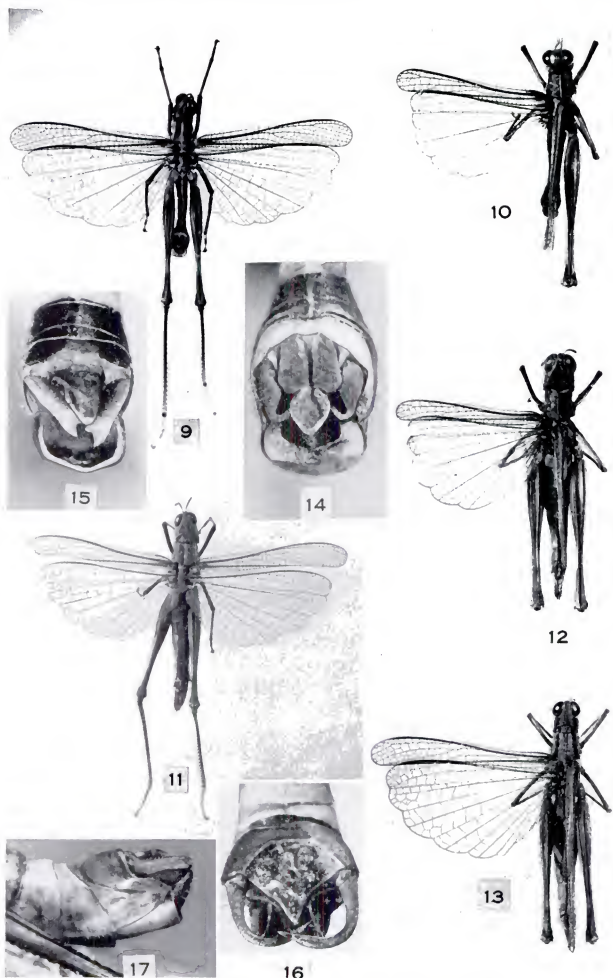
EXPLANATION OF PLATES 1 AND 2

PLATE 1.

- Fig. 1.—*Temnomastax borellii* (Giglio-Tos). Male. Chapada, Matto Grosso, Brazil. Lateral view. ($\times 3$.)
- Fig. 2.—*Masyntes camaguei* new species. Male (*type*). Camaguey, Cuba. Lateral view. ($\times 3$.)
- Fig. 3.—*Masyntes macaca* new species. Male (*type*). Loma del Gato, Oriente, Cuba. Lateral view. ($\times 3$.)
- Fig. 4.—*Eumastacops unca* new species. Female (*allotype*). Itacoatiara, Amazonas, Brazil. Dorsal view. ($\times 2\frac{1}{2}$.)
- Fig. 5.—*Eumastacops unca* new species. Female (*allotype*). Itacoatiara, Amazonas, Brazil. Lateral view. ($\times 2\frac{1}{2}$.)
- Fig. 6.—*Eumastacops plebeja* (Gerstaecker). Female (*type*). Fonteboa, Amazonas, Brazil. Dorsal view. ($\times 2$.)
- Fig. 7.—*Eumastacops parishii* new species. Female (*type*). Kartabo, British Guiana. Lateral view. ($\times 2\frac{1}{2}$.)
- Fig. 8.—*Eumastacops caligo* new species. Male (*type*). Teffe, Amazonas, Brazil. Lateral view. ($\times 2\frac{1}{2}$.)

PLATE 2.

- Fig. 9.—*Eumastacops militaris* (Gerstaecker). Male (*type*). Olivença, Amazonas, Brazil. Dorsal view. ($\times 2$.)
- Fig. 10.—*Eumastacops caligo* new species. Male (*type*). Teffe, Amazonas, Brazil. Dorsal view. ($\times 2\frac{1}{2}$.)
- Fig. 11.—*Eumastacops militaris* (Gerstaecker). Female (*allotype*). Fonteboa, Amazonas, Brazil. Dorsal view. ($\times 1\frac{1}{2}$.)
- Fig. 12.—*Eumastacops parishii* new species. Female (*type*). Kartabo, British Guiana. Dorsal view. ($\times 2\frac{1}{2}$.)
- Fig. 13.—*Eumastacops nemorivaga* new species. Female (*allotype*). Teffe, Amazonas, Brazil. Dorsal view. ($\times 2\frac{1}{2}$.)
- Fig. 14.—*Eumastacops militaris* (Gerstaecker). Male (*type*). Olivença, Amazonas, Brazil. Dorsal view of apex of abdomen. (Greatly enlarged.)
- Fig. 15.—*Eumastacops caligo* new species. Male (*type*). Teffe, Amazonas, Brazil. Dorsal view of apex of abdomen. (Greatly enlarged.)
- Fig. 16.—*Eumastacops unca* new species. Male (*type*). Demerara River, British Guiana. Dorsal view of apex of abdomen. (Greatly enlarged.)
- Fig. 17.—*Eumastacops unca* new species. Male (*type*). Demerara River, British Guiana. Lateral view of apex of abdomen. (Greatly enlarged.)



REHN AND REHN: A REVIEW OF THE NEW WORLD EUMASTACINAE
(ORTHOPTERA, ACRIDIDAE).—PART II

ADDITIONAL NOTES ON WEST INDIAN BIRDS *

BY JAMES BOND

*Associate Curator Birds of the Americas, The Academy of Natural
Sciences of Philadelphia*

It is my intention to publish, as occasion warrants, distributional information on West Indian Birds supplementary to that contained in my Check-List (1940), rather than await the time when it will be necessary to bring out a second edition of this list. The present paper thus includes all important records which have been overlooked or which were received since publication of the above work.

A check-list can never be completely satisfactory, even from the point of view of the author. There are always puzzling problems pertaining to inconsistencies of treatment that are difficult to overcome. For example, representative forms, differing merely in degree of coloration or size, I have usually regarded as conspecific, but this may not always be correct. If *Todus multicolor* and *T. subulatus* were representative, as indeed they are in Haiti, I would be inclined to consider all of the todies as comprising one species. Since, however, the two Hispaniolan birds are said to occur together in parts of the Dominican Republic this is impossible. Furthermore, although *T. subulatus* is to a slight extent the most aberrant of the genus, it would hardly be justifiable to unite the others under one species.

I believe it is wrong to regard all representative forms as conspecific, but rather that every genus should be reviewed differently in order to show best the relationship and origin of the forms it comprises. To regard all the bananaquits (*Coereba*) as races of *C. flaveola* is scarcely an improvement over the older idea of classifying them as different species. In my Check-List I have treated the West Indian forms of this genus under two species, *C. flaveola* and *C. bahamensis*, although the differences separating these are less than exist between *Mimocichla ardosiacea* and *M. plumbea* which I consider geographical races to show the distinctness of the one aberrant, although representative form (*M. ravidia*) from Grand Cayman.

In this paper I have discussed the origin of a few West Indian birds. This is always an interesting topic but unfortunately usually more or less futile. For example, the oriole of St. Andrews Island in the south Caribbean may have been derived from Jamaica as the result of a hurricane, but it may well have reached the island from Central America, although the species (*Icterus leucopteryx*) is not now found on the mainland. The best

* See also *Notulae Naturae*, no. 15, 1939.

one can do is to present for future ornithologists an accurate and unprejudiced picture of conditions as they are today, so that comparisons, which will eventually be made and which may throw light on problems of zoögeographic distribution, will be based not on theory but on fact.

Phaëthon lepturus catesbyi Brandt

Considered of hypothetical occurrence on Montserrat by Danforth (Journ. Agric. Univ. Puerto Rico, 23, 1939, p. 51), who referred to my remarks on tropic-birds (Birds of the West Indies, 1936, p. 8). But I made it quite clear that only *Ph. aethereus* was observed at Montserrat. Both species have recently been found nesting on Virgin Gorda (Beatty).

Pelecanus occidentalis subspecies

Cory stated that pelicans are "abundant throughout the Bahamas . . . and breed in great numbers on some of the islands" (Birds of the Bahama Islands, 1880, p. 196). I have not found them common among the Bahamas, although their range is not as restricted as is indicated in my Check-List. The species (*P. o. occidentalis?*) is known to be not uncommon among the Caicos Islands.

Sula dactylatra dactylatra Lesson

A small colony of about five pairs found breeding on Cockroach Cay, Virgin Islands (Beatty). Among other sea birds found nesting there or on neighboring islets were *Fregata magnificens rothschildi*, *Gelochelidon nilotica*, *Sterna f. fuscata*, *Sterna anaethetus melanoptera*, and *Anoïs s. stolidus*. The last mentioned species has also been recorded as nesting in abundance on Redonda, and its eggs have lately (May 9, 1940) been taken at Grand Bay, Dominica (Agar).

Sula sula (Linnaeus)

The type locality should be Barbados, not Ascension Island, whence this species has not definitely been recorded.

Anhinga anhinga leucogaster (Vieillot)

Cuban birds belong to the northern race, the type locality of which is Florida (Bull. Mus. Comp. Zool., 88, no. 3, 1941, p. 103).

Coragyps atratus atratus (Bechstein)

There are sight records of the Black Vulture from Cuba (Cory; Danforth, near Santiago; Bruner, outskirts of Havana) and old records from Jamaica (March). I know of no West Indian specimen in any collection.

Chondrohierax wilsonii (Cassin)

Formerly known from as far west as Santa Clara (vicinity of Trinidad).

***Buteo jamaicensis solitudinis* Barbour**

It has been pointed out to me by my friend, Sr. Veiga-Azcune, who has always evinced much interest in Cuban Raptores, that the Red-tailed Hawk is far more numerous in Cuba than the Broad-winged Hawk (*Buteo platypterus cubanensis* Burns), and is of widespread distribution on the island, being particularly numerous in wooded sections.

***Buteo platypterus brunnescens* Danforth and Smyth**

I have recently examined the type and only specimen from Puerto Rico in the United States National Museum and consider *brunnescens* a well-marked race. The Puerto Rican form of the Broad-winged Hawk should be included among those West Indian birds that are in danger of extinction.

***Buteo platypterus antillarum* Clark**

I found this hawk to be not uncommon on Tobago when I visited this island in 1937. I found it also on Little Tobago, in company with the Great Bird-of-Paradise (*Paradisaea apoda*) now well established on this islet. I had no collecting permit, but specimens have been taken on Tobago, one of which is in the United States National Museum. This, according to Dr. Herbert Friedmann, is to be referred to the southern Lesser Antillean race. The species was omitted from "Birds of the Colony of Trinidad and Tobago" by Belcher and Smooker (Ibis, 1934-37), who evidently overlooked Cory's list of birds from Tobago taken by the well-known collector Wilmot W. Brown in 1892 (Auk, 1893, p. 220).

***Polyborus cheriway audubonii* Cassin**

Audubon's Caracara has been termed "Rey de las Auras" in Cuba, but this is a misnomer. The Turkey Vulture is certainly the more powerful bird and recent evidence has shown that when it is feeding the caracara is forced to remain at a distance. Possibly well-fed Turkey Vultures, seen near a carcass on which caracaras were feeding, has given rise to the impression that the latter birds are dominant.

***Colinus virginianus* subspecies**

North American quail have been introduced (for the most part many years ago) on numerous islands in the West Indies. Little is known for certain from which parts of the United States or Mexico these birds originated. In Cuba, at the present time, quail show much variation owing to interbreeding of introduced birds with the resident form (*cubanensis*). Fortunately there has been no mixture of races on the Isle of Pines, so that one still finds pure-blooded *cubanensis* here. Wetmore refers Haitian birds to the nominate race, although he states that the only specimen from this Republic in the United States National Museum is "decidedly darker than those from the central and northern states" and "much more buffy below"

than specimens from South Carolina (Birds of Haiti and the Dominican Rep., U. S. Nat. Mus., Bull. 155, p. 123). Antiguan specimens appear to be of mixed breed (Birds Amer., pt. 1, no. 1, 1942, p. 240). In the latest edition (1931) of the A. O. U. Check-List it is stated that *texanus* was introduced into Haiti, on whose authority I cannot say. Moreover, it is by no means certain that Bahaman quail were derived solely from Florida. It appears certain, however, that Jamaican birds can be referred to *virginianus*.

***Numida meleagris galeata* Pallas**

The Guinea Fowl is now well established in Cuba (from Matanzas Province eastward), Hispaniola and Barbuda.

The Haitian name for this bird ("Pintade Marronne") is derived from the word "marron", applied in the past to a negro slave who had fled into the woods (hence the Jamaican "maroon").

***Cyanolimnas cerverai* Barbour and Peters**

This remarkable rail is not flightless as was believed by Friedmann (U. S. Nat. Mus., Bull. 50, pt. 9, 1941, p. 98). I once saw one fly, or rather flutter across the canal near Santo Tomás (about ten feet) and my friend Veiga-Azcune who visited this locality with Cervera writes me that he flushed one individual twice, finally catching it alive. He states that the bird flew "a very short distance, dragging its legs." I shot two adult males, both within a few feet of the canal, and near the high, dry territory of Santo Tomás.

***Porzana flaviventer hendersoni* Bartsch**

Two females from the Dominican Republic in this Academy's collection are less rufescent as well as smaller than a male and a female from Cuba (*P. f. gossii*). Their wings measure 61-63 mm. as compared with 68.5-70.5 mm.

***Laterallus jamaicensis jamaicensis* (Gmelin)**

Friedmann has shown that the Jamaican Black Rail, probably now extinct, is distinguishable from *L. j. pygmaeus* (Blackwall) of eastern North America (U. S. Nat. Mus., Bull. 50, pt. 9, 1941, p. 159). However, four Cuban specimens I have examined (taken in autumn), appear to be referable to the latter race, as are perhaps Puerto Rican individuals and a female from Jamaica in the collection of the American Museum of Natural History.

***Gallinula chloropus* subspecies**

Fisher and Wetmore (Proc. U. S. Nat. Mus., 79, art. 10, 1931, p. 5) consider that a Florida Gallinule seen on Grand Cayman was probably the North American *G. c. cachinnans*, stating that "it would seem of necessity to be a migrant." I cannot agree with this surmise, since these gallinules are by no means confined to fresh-water lakes and ponds in the West Indies.

I found the Florida Gallinule common and nesting in company with Caribbean Coots and Ruddy Ducks in a mangrove-fringed lagoon (known as Canada Pond) at St. Kitts in late December and early January 1929. According to Danforth (Birds of St. Kitts and Nevis, 1936) this lagoon is dry during the summer months and therefore no gallinules are present at this season. Since this appears to be the only suitable locality for this species on St. Kitts, it would seem that there is some inter-island movement among resident West Indian gallinules, coots and other water birds, depending on water conditions.

There is apparently no definite record of *G. c. cachinnans* from anywhere in the West Indies. Wetmore and Swales state (Birds of Haiti and the Dominican Rep., 1931, p. 138) that Bahaman as well as Antillean Florida Gallinules are referable to "*portoricensis*" (= *cercercis*), and Hellmayr and Conover consider Tobago birds to be this form.

Fulica species

When duck-shooting in southern Pinar del Rio in late January 1941, several members of the party brought in some coots that they had shot. On examining these I found that all but one were apparently typical *americana*. The exception was much nearer *caribaea* in that the frontal shield lacked any trace of a red plate covering the distal portion. The shield itself was large and much swollen. At the upper, posterior end it was slightly discolored with red, in which it differed from the shields of any specimen of *caribaea* that I have examined. These, however, are frequently discolored with yellow. I am inclined to think that the bird, now in the collection of Sr. Gastón Villalba of Havana, is a hybrid *americana* × *caribaea*. Although certainly nearer *caribaea* in the form and coloring of the frontal shield, it has a wing measurement of 203 mm., well over the maximum of that species. It seems reasonable to believe that *F. caribaea* should occasionally occur in Cuba, since it is common in Hispaniola and on many other of the Antilles. There is a female in the American Museum of Natural History taken in Trelawny Parish, Jamaica, the first record of the species from this island where it may be a not uncommon resident.

In the Field Museum in Chicago there is a specimen taken in northern Haiti that appears to be a hybrid *americana* × *caribaea* (cf. Check-List Birds of the West Indies, 1940, p. 33, footnote 25). In this case only a trace of the red plate is attached to the upper part of the shield. Similar examples have been collected by Beatty on St. Croix (cf. Danforth, Journ. Agric. Univ. Puerto Rico, 19, 1935, p. 448). It is apparent that *F. caribaea* is very closely related to *F. a. americana*, more so in my opinion than is the latter to the coot known as *F. a. peruviana* Morrison of the Andes of South America. The last mentioned coot is a very much larger bird, although its

wings are proportionately short. Furthermore, it lacks the broad white tips to the secondaries, characteristic of *americana* and *caribaea*.

The American Coot (*F. a. americana*) is a common winter resident in Cuba and is not rare in Hispaniola during this season. Recent field work (Bond,—1941, 1942) in the Bahamas indicates that the bird occurs more commonly on these islands than was hitherto supposed. East of Hispaniola, in the Greater Antilles, there are very few definite records (Danforth,—Puerto Rico and St. Croix).

The status of resident American Coots in Jamaica and in Hispaniola remains to be determined by field work undertaken during the summer months. In Haiti I found *F. caribaea* nesting in early April when winter resident coots are virtually in breeding condition, so that hybridization of resident with winter resident individuals might be expected.

There appears to be some confusion concerning the coots of the southern Lesser Antilles. The only definite record of *F. americana* from these islands is the type of *F. a. grenadensis* Riley from Isle Ronde, one of the more southern of the Grenadines. This specimen I have examined and consider it to represent merely a winter resident or transient individual of *F. a. americana* in full breeding condition with swollen frontal shield. It was collected on May 9. Records of *Fulica caribaea* from St. Barts, St. Lucia, St. Vincent and Barbados (U. S. Nat. Mus., Bull. 50, pt. 9, 1941, p. 222) are probably correct but are not definite and require confirmation since they may pertain to *F. americana* (cf. Wetmore, Auk, 1928, p. 370).

When last on Grenada I visited both the "Grand Etang" and Lake Antoine. The former is merely a little woodland pond, and hardly suitable for coots to nest. But Lake Antoine is quite extensive and here I found and collected breeding specimens of *F. caribaea* and observed newly hatched young of this species. No individuals of *F. americana* were observed, and at the time of my visit (in March) the pond on Isle Ronde was dry so that no coots were present there nor were any found on neighboring islets.

Wetmore states (Birds of Haiti and the Dominican Rep., 1931, p. 41) that the name "Geoudel", applied to coots in Haiti, is of uncertain meaning. It is of interest to note that the European Coot (*F. atra*) is known in France as "Judelle." Incidentally, the local Haitian name of the Sharp-shinned Hawk (*Accipiter s. striatus*) is unquestionably "Emouchet", commonly applied in France to *Accipiter nisus*, and not "Vers-mouchette" as given in my handbook.

Haematopus ostralegus prattii Maynard

This form can be distinguished readily from *palliatu*s, the bill of the former being thicker, although not longer. This thickness is most noticeable anteriorly, and one can determine the race merely by feeling the end of the

bill. All adult West Indian specimens that I have examined, from Abaco to the Grenadines, are referable to *prattii*.

***Sterna hirundo hirundo* Linnaeus**

I have examined a specimen of this tern in the Museo Poey, taken in May 1940, by Sr. Cleto Sánchez at Matanzas. Another example, taken by Sánchez, is in the collection of the Havana Academy of Sciences. This species has also been taken recently near St. Croix (September and October).

***Thalasseus sandvicensis acufavidus* (Cabot)**

A large colony was found on the Ragged Islands in the Bahamas (Bartsch), not on Cayo Rosario, Cuba, as stated in my Check-List. Observed at Bird Rock and Acklin Island where the birds were evidently preparing to breed (Cory).

***Columbigallina passerina exigua* Riley**

Specimens from Little Inagua and from the Turk and Caicos Islands are grayer, less brownish above than typical *bahamensis* and average smaller. They are best referred to *exigua*.

***Oreopeleia mystacea* (Temminck)**

Taken on Tortola by Beatty but not found by him on Virgin Gorda in spite of diligent search. Records of the Ruddy Quail-dove (*O. m. montana*) from the Virgin Islands (St. Thomas and St. Croix) are almost certainly erroneous. Hellmayr and Conover do not consider *beattyi* to be a valid race (Cat. Birds Amer., pt. 1, no. 1, 1942, p. 601).

***Oreopeleia caniceps leucometopius* Chapman**

A "perdrix bleue" is said to be found in the woods north of Saltrou in extreme southeastern Haiti (Felix Viard).

***Tyto glaucops* (Kaup)**

A barn owl, presumably this species, was noted on Tortuga Island (Haiti) by Abbott. An owl is said to have been observed by lighthouse keepers on Navassa Island, Haiti (Ekman). This was perhaps the migratory *Asio f. flammeus* rather than a *Tyto*.

***Otus nudipes newtoni* (Lawrence)**

A set of eggs of this rare owl and eggs of the Least Bittern, Oystercatcher, Common Tern, and a nightjar (believed to be *Ch. m. gundlachii*), have recently been collected in the American Virgin Islands (Nichols).

***Speotyto cunicularia floridana* Ridgway**

I found burrowing owls quite common on New Providence in August 1940. In winter they are apparently very rare but not lacking on the northern Bahama Islands. There is some evidence of migratory movements.

Dr. Frank Chapman tells me of a burrowing owl seen flying south in the Fortune Island Channel on November 23, 1935, possibly headed for Inagua. I am inclined to believe that those seen on the night of January 12, 1937, in the Florida Keys by Alexander Sprunt (Auk, 1938, pp. 532-5) came from the Bahama Islands.

***Nephoecetes niger niger* (Gmelin)**

I found the Black Swift common as late as mid-December in the Blue Mountains, Jamaica, so this bird may be resident on this island. Davis records a swift, believed to have been this species, as "abundant" in the Trinidad Mountains, Cuba, and states that he observed "several flocks of more than one thousand" of the Cloud Swift (*Streptoprocne*) near Cienfuegos during June and July (Wilson Bull., 1941, p. 38).

It is of interest to note that the nidification of the Black Swift (in Dominica) resembles that of *Streptoprocne zonaris*, *Cypseloides major*, and *Cypseloides rutila* (in South America), indicating relationship with these species. The above forms lay but one relatively large egg and none is known to use the glutinous saliva in nest construction which is characteristic of *Chaetura*. *Cypseloides rutila* has recently been transferred by Peters to the genus *Chaetura* (Check-List of Birds of the World, pt. 4, 1940, p. 239).

***Glaucis hirsuta insularum* Hellmayr and Seilern**

Grenada is the only Lesser Antillean island where this hummingbird is found and is the only mountainous island of the group not inhabited by *Eulampis jugularis*. The latter species may well have been extirpated on Grenada through competition with *Glaucis*.

It is remarkable that the avifauna of Grenada has remained so fundamentally Antillean, since it lies so near Trinidad. Tobago, on the other hand, has many Neotropical birds. The bird-life of these islands thus indicates that the former (Grenada) is oceanic, at least in the sense that it has had no recent connection with the mainland, and the latter (Tobago) is continental and was once united with Trinidad. It is inconceivable to me that the Neotropical species found on Tobago would not thrive equally well on Grenada. A guan (*Ortalis ruficauda*) has been introduced on certain of the Grenadines where reports show that it is doing very well.

I believe that few South American birds have reached Grenada, rather than that this island and other of the Antilles are "death traps" to continental species. Those that are found in the Lesser Antilles one might term aggressive forms (e.g. *Tyrannus melancholicus*, *Elaenia flavogaster*), as opposed to passive forms (e. g. members of the families Dendrocolaptidae, Formicariidae, etc.). During my field work in the American tropics I have seen *Oreopeleia m. montana* and *Coereba flaveola dominicana* several miles from land and there is a specimen of the latter from Martinique in the

collection of the Museum of Comparative Zoology at Cambridge, Mass., and one of *C. f. luteola* from Grenada in the collection of the Field Museum of Natural History in Chicago. But it is worthy of note that the Great Bird-of-Paradise (*Paradisaea apoda*), which has successfully been introduced on Little Tobago, has not yet been reported from Tobago proper, which is less than two miles distant: nor have the guans that have been introduced on the Grenadines spread to nearby islands. Mayr has stated (Proc. Pacific Sci. Congress, 4, 1939, p. 214) that "The open sea is like a sieve which lets pass only certain specially adapted elements." Rather is it a barrier over which only the more aggressive birds are wont to cross.

***Trochilus polytmus polytmus* Linnaeus**

This abundant Jamaican hummingbird is common as far east as Kingston and on Blue Mountain Peak, but the black-billed form replaces it at Port Antonio, Bath, and probably at Morant Bay. To the west of Port Antonio I hunted through country where neither bird was present. The specimen of *scitulus*, said to have been taken at "Kingston", was probably collected east of that town, which is near the eastern limit of the range of *polytmus*.

***Nesophlox evelynae lyrura* Gould**

Specimens of *Nesophlox* secured by the Fifth George Vanderbilt Expedition, 1941, of this Academy on Little Inagua are referable to *lyrura*. Those from West Caicos and Providenciales are *salita*, the race from the Caicos Islands, which is more or less intermediate between *lyrura* and *evelynae*.

Nesophlox evelynae is the only Bahaman species with no near relative in the Antilles or in Florida. The only other member of the genus is found in the mountains of Costa Rica and western Panama, so it must be considered a relict that probably at one time was found in Cuba and perhaps elsewhere in the Greater Antilles.

The majority of Bahaman birds were derived from Cuba. The Florida element is confined to the northern and western islands and is of more recent arrival. These islands are unquestionably oceanic so that it might appear strange that more Hispaniolan birds are not represented in view of the prevailing southeasterly trade winds. This, however, may be explained by the influence of hurricanes, which frequently sweep up from the Caribbean Sea and pass over the flat portions of Cuba with unabated force. Such storms also occasionally strike Hispaniola but are dissipated by the great mountain masses of that island. Hurricanes must carry birds considerable distances and are perhaps responsible for the presence of many forms of life now found in the West Indies. They may sometimes cause the extermination of a species. The thrush that was found on the Swan Islands (*Mimocichla plumbea eremita* Auct.), which I consider identical with the race from

central and western Cuba (*M. p. rubripes*), may have disappeared in this way, since its extirpation cannot be accounted for by other means.

Tyrannus melancholicus chloronotus Berlepsch

Zimmer has recently reviewed the tropical forms of this species (Amer. Mus. Novit., no. 962, 1937, pp. 14-21) and considers *chloronotus* (type locality = Temax, Yucatan) to range from southern Mexico to Colombia and Venezuela, including also Trinidad, Tobago, and Grenada. This race averages paler than *despotes*.

Myiopagis cotta (Gosse)

The genus *Myiopagis* is evidently worthy of recognition. It shows "a strong tendency toward the Cotingidae" (Zimmer, Amer. Mus. Novit., no. 1108, 1941, p. 20).

Progne subis cryptoleuca Baird

Bruner gives September 25 as the latest date on which he has seen this martin in Cuba (Mem. Soc. Cub. Hist. Nat., 12, 1938, p. 172), but there are numerous unpublished October records (Veiga-Azcune), the latest being October 21. The Cuban Martin winters in Central America (Guatemala and, apparently, British Honduras), at least to some extent. Specimens in this Academy were taken in Guatemala in February and March. This martin is not known from Cuba during the months of November, December, and January. I have no records of the other Antillean race (*dominicensis*) during the months of October, November, and December.

A Mexican form (*P. s. sinaloae*), specimens of which I have recently examined, appears to be a valid race. Mr. Robert Moore writes me that Chester Lamb discovered a breeding colony in Nayarit, and further informs me that there are no winter records of *sinaloae*. It seems remarkable that such conspicuous birds should disappear so completely, but it must be remembered that few ornithologists have visited the West Indies during the autumn months and it is quite possible that some individuals of *dominicensis* are resident on the islands, at least in Hispaniola and Jamaica.

Troglodytes musculus martinicensis (Cory)

W. E. Richardson collected specimens of this wren and of the White-breasted Thrasher (*Ramphocinclus b. brachyurus*) in 1886. They do not appear to have been taken since and are now probably extinct. However, Martinique is not as well known ornithologically as any of the other Lesser Antilles.

The Lesser Antillean wrens have presumably disappeared because of the depredations of the mongoose, although it is difficult to explain the fact that they are still numerous on Grenada. The Trinidad and Tobago forms are likewise common (see my Birds of the West Indies, p. 272).

I personally feel convinced that the extinction or near extinction of so many West Indian birds in historic times was brought about in all cases either directly or indirectly by man.

***Turdus swalesi* (Wetmore)**

This beautiful Thrush is known only from the La Selle ridge in south-eastern Haiti, being most abundant in the dense brush, known locally as "raque-bois", on the summit of the ridge at an altitude of 6000 feet and upwards, where it appears to occur to the exclusion of the widespread Red-legged Thrush (*Mimocichla plumbea ardosiacea*). At a little lower elevation, on what might be called the La Selle plateau, both species are found, the La Selle Thrush being the commoner. Below 5000 feet on the southern slope (the northern side of the ridge is precipitous) in the "Jardins Bois Pin", where much of the forest has been cleared away during the past ten years, I found only the Red-legged Thrush in 1941. The range of the La Selle Thrush appears to be very circumscribed but probably extends from Morne La Selle proper at the eastern end of the ridge, where it was observed by Abbott, to Morne L'Enfer at the west, the latter locality being but a short distance from the type locality, Morne La Visite. At one time I thought its range might extend eastward across the Dominican border into the Sierra de Bahoruco, but I now doubt this after a visit in June 1941, to the Mornes Commissaires in extreme eastern La Selle, at which point there is a definite faunal break. In late May and in early June on the La Selle ridge there are thunderstorms with heavy precipitation nearly every afternoon, and dense clouds cover the summits of the mountains. I was surprised, therefore, to find the pine forests of the Mornes Commissaires quite arid during the first week in June, and the country for the most part unfavorable to a number of La Selle birds, such as the La Selle Thrush and Chat Tanager, although such species as the Elaenia, Goldfinch, and Pine Warbler abounded there.

The song of the La Selle Thrush somewhat resembles those of thrushes of the genus *Mimocichla* but its tone is superior and more robin-like. Its call-note is a liquid gurgle. The species nests in the scrub at low or moderate elevations above the ground. Nests found by me in late May 1941, in the vicinity of Morne Cabaio, were composed of grasses, covered externally with moss. One's first impression is that the structure is built entirely of the latter material. The eggs are a beautiful "robin's egg blue", rather evenly spotted with grayish brown and lilac-gray. They are quite different from those of the Red-legged Thrushes and also from those of the Hopping Dick (*Turdus aurantius*) of Jamaica.

I was informed that in 1934 the mongoose was introduced into Haiti on the old pretext "to kill the rats." How far it has accomplished this purpose

I cannot say, but I do know that this pest has penetrated into the mountains of the Massif de la Selle and that many birds inhabiting this region have decreased startlingly since my previous visit in 1930. Todies and Ground Warblers have suffered in particular. The Gray-breasted Ground Warbler (*Microligea p. palustris*) is now rather rare, and the White-breasted Ground Warbler (*Microligea montana*) decidedly rare in this region. I also noted a change in the habits of the Limpkin, probably attributable to the mongoose. Whereas in former years these birds in Hispaniola would flush only if hard pressed, in 1941 I repeatedly saw them take to wing (cf. Proc. Acad. Nat. Sci. Phila., 80, 1930, p. 494). The La Selle Thrush appears, however, to be holding its own very well. Its nests are out of reach of the mongoose and for the most part are too well hidden for the over-abundant crows (*Corvus p. palmarum*) to discover.

Cichlherminia l'herminieri l'herminieri (Lafresnaye)

This thrush was rediscovered in Guadeloupe by the late Stuart Danforth who saw some 20 individuals and collected specimens in 1937. It has evidently learned to build its nest in trees high above the ground and is in no immediate danger of extinction.

Vireo griseus griseus (Boddaert)

I was apparently in error in recording this North American bird from Swan Island. There is a record of the White-eyed Vireo from Saint Andrews Island (Cory, Auk, 1887, p. 181), based on two skins taken by Robert Henderson in 1887. These specimens, which are part of the collection of the Field Museum of Natural History, are now before me and are not *V. g. griseus*. Two more specimens recently collected on St. Andrews by the Fifth George Vanderbilt Expedition, 1941, of this Academy, agree with Henderson's skins. The four examples represent an endemic insular form (*Vireo caribaeus* Bond and de Schauensee, Not. Nat., no. 96, 1942).

I believe the White-eyed Vireo (*V. griseus*) to be of Mexican origin. The species has reached Bermuda but is presumably unable to establish itself on the Bahamas owing to the presence of *V. crassirostris*. The distribution of the latter species indicates that it reached the Bahamas via Caribbean islands from Central America, where we find the closely allied *V. pallens*.

Vireo altiloquus subspecies

V. a. barbatulus is known to winter in northern South America, having been recorded from Panama (Obaldia), Colombia, Peru, and from northern Brazil (Manaos, Rio Negro, etc.). The winter range of the nominate form lies as a whole somewhat to the eastward of that of *barbatulus*, viz. the Canal Zone, northern Brazil, Venezuela, and British Guiana. The Lesser Antillean *barbadensis* appears to be for the most part resident, particularly

on the more southern islands. A record of this form from Trinidad (Zimmer, Amer. Mus. Novit., no. 1127, 1941, p. 20) may pertain to a transient or winter resident individual, although *barbadensis* nests on this island according to Smooker (Belcher and Smooker, Ibis, 1937, pp. 513-14). I doubt that a specimen taken at Calovevora, Veragua, Panama, is *barbadensis*, to which race Zimmer tentatively refers it.

The nominate form has been recorded from Sombrero and Saba by Ridgway (Birds of North and Mid. Amer., vol. 3, p. 138) and *barbadensis* from "Santa Cruz" (= St. Croix) by Zimmer (Amer. Mus. Novit., no. 1127, 1941, p. 20). On islands of the West Indies, at the juncture of the ranges of two races belonging to a widespread species, specimens typical of each form in addition to intermediates are often found together (cf. Auk, 1939, p. 194). Thus I deem it best to regard the ranges of *alticola* and *barbadensis* to be as given in my Check-List.

***Dendroica petechia babad* Bond**

This golden warbler is found on the northwest coast of St. Lucia, not northeast coast as stated in my Check-List.

***Dendroica petechia gundlachi* Baird**

Examination of a large series of Golden Warblers from various islands in the Bahamas (including topotypes from Rum Cay) and Cuba, mostly from the collection of the United States National Museum, convinces me that birds from these islands are indistinguishable and that Bahaman Golden Warblers should be referred to the Cuban race. The characters whereby "*flaviceps*" is said to differ from *gundlachi*, such as the more rounded wing, longer tarsus and brighter coloration, do not hold. It may also be mentioned that many apparently adult males both of *gundlachi* and "*flaviceps*" lack even a trace of rufous on the crown.

Chapman when describing *flaviceps* compared his Bahaman specimens with a small series from Jamaica. Birds from this latter island belong, however, to a distinct race (*D. p. eoa*) most nearly related to the Hispaniolan form *D. p. albicollis*. Specimens from Hispaniola can be distinguished from *gundlachi* chiefly by their brighter yellowish green upper parts. Hellmayr states (Birds of the Americas, pt. 8, 1935, p. 370) that *albicollis* "has the bill shorter and slenderer than in the other forms from the Greater Antilles and the Bahamas", but this is certainly not the case in the series before me (cf. also Peters, "A revision of the Golden Warblers", Proc. Biol. Soc. Wash., 40, 1927, pp. 31-41).

The Golden Warblers of the Bahamas, like the majority of land birds from these islands, must be considered of Cuban origin, although those from the Cayman Islands were apparently derived from Jamaica. A pair (*D. p.*

gundlachi) was found nesting on one of the Lower Florida Keys in June 1941 (Auk, 1942, p. 114).

***Dendroica dominica dominica* (Linnaeus)**

This is the first of the North American warblers to reach the islands (July 22, in Cuba,—Gundlach; July 26 near Nassau,—Bond) and is one of the earliest to leave in the spring. Latest spring records of migrant warblers in the West Indies are of *Mniotilta varia* and *Setophaga ruticilla* in western Cuba (May 25,—Bruner, "Calendario de la Migracion de las Aves en Cuba Occidental," Mem. Soc. Cub. Hist. Nat., 1941, p. 325).

***Dendroica pityophila* (Gundlach)**

I have just received word from my friend Sr. Gastón Villalba of the finding of the first nest of this species near Bacunagua, Pinar del Rio. The little cup was situated well out on a small branch of a pine about 30 feet above the ground and contained two young about ready to leave (June 13). Incidentally, this was the only species of *Dendroica* of which the nidification was unknown.*

***Holoquiscalus lugubris fortirostris* (Lawrence)**

In January 1930, I saw on Antigua an unmistakable female *H. l. guadeloupensis* which unfortunately I was unable to collect. It was associating with a large flock of *fortirostris*. The great majority of the grackles on this island are unquestionably the Barbadian race. A female (A.N.S.P. 138468) is typical of the dark bird from Barbados. Four males from Antigua have wing measurements of 108, 109, 111, 112 mm. respectively.

Intensive search on St. Vincent in June 1929 failed to reveal more than one race of *Holoquiscalus* inhabiting this island, i.e., *H. l. contrusus*, a bird with notes different from those of either *fortirostris* or *luminosus*. It is possible that *fortirostris*, which has been taken on St. Vincent (*H. f. dispar* of authors), was brought to the island from Barbados, since it is known to have been introduced on two or three of the northern islands of the Lesser Antilles. Subsequently it probably disappeared through interbreeding with the native *contrusus*.

A male grackle that I collected on St. Vincent (A.N.S.P. 81236) I have recorded (Proc. Acad. Nat. Sci. Phila., 80, 1928, p. 542) as *luminosus*, the race from Grenada and the Grenadines. Reexamination of this specimen convinces me that it cannot be considered an individual variant of *contrusus*, and I believe the bird was a straggler from the Grenadines.

* *D. potomac* Haller, known only from West Virginia, may eventually prove to be a hybrid (*D. dominica* × *Parula americana*). An unusually virile male or over-sexed female would be more likely to hybridize outside the normal breeding range of the species (in this case *D. dominica*), where no mate of its kind is available.

***Icterus cucullatus* subspecies**

Gundlach recorded taking a nearly adult male of this species in Cuba in April 1859 (Ornit. Cubana, 1893, p. 115). This is evidently the specimen labeled "113" in the Gundlach Collection in Havana, which I recently examined. The record has previously been questioned but must be accepted on the basis of this skin. I have noted the species as a cage-bird in Havana.

***Agelaius phoeniceus assimilis* (Lembeye)**

The Cuban form of the Red-winged Blackbird is not altogether restricted to the Zapata Swamp, having been recorded from near Cardenas in 1917 (Barbour), and from the Laguna de Jovero, about 12 miles south of Guane, in extreme western Cuba in 1940 (Miguel Saludes; specimen examined,—Bond).

***Tiaris canora* (Gmelin)**

Barbour in his "Birds of Cuba" (p. 129) states as follows in regard to this little finch: "Why the Melodious Grassquit, which does not sing, should be called by the Cubans Tomeguin del Pinar, I cannot say. The Spanish name is fully as inapt as the English, as it implies that the bird lives in the *pinares* or pine lands, which is entirely incorrect."

I found this grassquit one of the commonest birds in the *pinares* of Pinar del Rio. In fact it appears to be more numerous in this environment than elsewhere in this Province. Furthermore, I frequently heard both wild and captive individuals emit a pleasant but weak song.

***Loxigilla noctis barbadensis* Cory**

I wish to withdraw a sight record of a black *Loxigilla* noted on Barbados on my return from Brazil in 1926 (Proc. Acad. Nat. Sci. Phila., 80, 1928, pp. 543-4). I now believe the bird to have been a Glossy Cowbird (*Molothrus bonariensis minimus*).

***Zonotrichia capensis antillarum* (Riley)**

Chapman has shown that this species is best placed in the genus *Zonotrichia*, since, to call this sparrow *Brachyspiza* gives no clue to its relationship or geographic origin (see Bull. Amer. Mus. Nat. Hist., 77, art. 8, 1940). I do not, however, agree with him in believing that the Antillean form was derived from North America, but rather that it reached Hispaniola from Central America. In discussing his theory, Chapman mentions the Cuban *Grus*, *Colinus*, *Campephilus*, and *Colaptes* and also the Hispaniolan White-winged Crossbill (*Loxia leucoptera megaplaga*) as being of North American origin, and I might add the Bahaman forms of *Dryobates*, *Sitta*, *Dendroica dominica*, *Geothlypis*, and *Agelaius*. But all of these are, or might well be, considered merely geographical races of birds inhabiting the eastern United States, and thus the West Indian forms of these species may be re-

garded as having reached the islands comparatively recently. It is highly questionable, however, that the Cuban *Campephilus* was derived from the Southern States. The contrary is more likely, assuming that the Cuban form became specifically distinct from *C. imperialis* through isolation. This would explain the presence of the two very different species on the mainland.

The Hispaniolan *Zonotrichia* has no very near relative in North America, but is closely related to the two Central American forms of *Zonotrichia capensis*, viz. *septentrionalis* and *costaricensis*. It probably reached the island via what is now the Mosquito Bank and Jamaica at a time when the former was above sea level, at least to a considerable extent, perhaps during the last glacial period (approximately 30,000 years ago) when temperatures were lower and when it may be assumed that the ranges of the Central American races were not disconnected. It evidently did not thrive in the Antilles, and even in Hispaniola at the present day this bird has a more circumscribed range than any other species found on the island, with the exception of a thrush (*Turdus swalesi*).

I have always maintained that the older element of both the Greater and Lesser Antillean avifauna reached the islands from Central America. Included of course is the remarkable *Dulus*, which has no known relative anywhere and is doubtless a relict which has died out on the mainland. The Todidae on the other hand, are related to the motmots of unquestionable Central American origin. *Zonotrichia capensis*, in addition to such birds as *Porzana flaviventer* and *Nyctibius griseus*, one must consider comparatively recent arrivals from Central America.

I have noted the extraordinary nature of the song of the Hispaniolan *Zonotrichia* as compared with those of mainland forms of *Z. capensis*, but do not consider this of much significance. Incidentally, the Jamaican bananaquit possesses a song (a rapid trill like that of the North American Worm-eating Warbler) very different from that of any of the 13 other West Indian races, all of which I know in life.

I have recently examined a specimen of one of the South American forms of *Z. capensis* in the Bauzá Collection. This was taken in Havana and was doubtless an escaped cage-bird.

Additional Records of Indigenous Birds

Anas b. bahamensis (common on Andros in winter,—Charles Bethel); *Oxyura jamaicensis* (New Providence,—Cory); *Oxyura dominica* (Guadeloupe,—Danforth); *Charadrius alexandrinus tenuirostris* (Turk and Caicos Islands); *Oxyechus vociferus rubidus* (Turk and Caicos Islands); *Himantopus himantopus mexicanus* (Cay Sal and Acklin Island); *Zenaida a. asiatica* (Caicos Islands, viz. Cockburn Harbour,—Greenway); *Dryobates villosus piger* (Mores Island, between Grand Bahama and Abaco,—Greenway);

Elaenia fallax cherriei (found at an altitude of not over 500 meters on road to Fond Verettes, Haiti,—Bond); *Callichelidon cyaneoviridis* (rare on, but not absent from, the northern, pine-forested islands in winter,—Bond); *Margarops f. fuscatus* (Crooked Island).

Records of North American Birds

Most of the following records of North American migrants are not included in my Check-List. Authorities are given for unusual unpublished records:—*Butorides v. virescens* (St. Thomas); *Anas acuta tzitzihua* (Andros, New Providence, Hispaniola); *Mareca americana* (Hispaniola); *Spatula clypeata* (not rare winter resident in western Cuba; several seen recently in Haiti by Anthony Curtiss); *Nyroca affinis* (Guadeloupe); *Circus cyaneus hudsonius* (St. Croix; November 2 to April 16); *Rallus l. limicola* (Cuban specimen with no data examined); *Porzana carolina* (Watling's Island, Dominica); *Numenius phaeopus hudsonicus* (French Cay, Bahamas); *Tringa s. solitaria* (Martinique); *Ereunetes mauri* (Mariguana and Turk Islands); *Himantopus himantopus mexicanus* (Cay Sal, Acklin Island); *Larus argentatus smithsonianus* (Jamaica and Cayman Brac; banded specimens found); *Hydroprogne t. tschegrava* (Haiti; banded specimen killed November 5, 1939); *Zenaida macroura carolinensis* (Dominican Republic; specimen banded in Florida, taken in late July!); *Asio f. flammeus* (St. Bartholomew); *Asio otus wilsonianus* (the Cuban specimen is in the collection of Dr. Mario Sánchez-Roig, not in that of José Bauzá as stated in my Check-List); *Caprimulgus v. vociferus* (the Cuban specimen was taken January 7, 1932); *Archilochus colubris* (specimen taken in western Cuba, January 26; apparently first winter record,—Villalba); *Tyrannus tyrannus* (Isle of Pines, September 23); *Myiarchus crinitus* (Cuba, Dec. 26,—Bauzá); *Protonotaria citrea* (St. Croix, October 6,—Beatty); *Helmitheros vermivorus* (St. Croix); *Limnothlypis swainsonii* (apparently winters in eastern Cuba, January 14,—Ramsden; but a transient only in western Cuba, September 25,—Villalba, and April,—Gundlach and Sánchez-Roig; taken in Jamaica March 16,—Newton Coll.); *Vermivora chrysoptera* (Cuba; October 10,—Bruner); *Vermivora pinus* (Cuba; March 4,—Villalba); *Dendroica dominica dominica* (Montserrat); *Dendroica pensylvanica* (western Cuba; May 2-11, September 11–October 14,—Villalba); *Dendroica castanea* (western Cuba; September 28, October 23, April 20,—Villalba); *Dendroica brevilinguis* (St. Croix); *Dendroica discolor collinsi* (St. Croix(!); October 24,—identified by Dr. Louis Bishop); *Wilsonia citrina* (St. Croix; March 16); *Nycticorax n. hoactli* (Grand Cayman; banded specimen).

Cuban records of *Moris bassana*, *Larus delawarensis* (in addition to other records of von Württemberg), and of *Larus hyperboreus* were rightly considered unsatisfactory by Barbour and therefore were not included in his "Birds of Cuba" (1923).

A specimen of *Falco peregrinus*, taken by Beatty November 9, 1940, on St. Croix, has been identified by Dr. Louis B. Bishop as the European race (*F. p. peregrinus*).

Records of Introduced Species

I have been informed that numerous birds, considered as game birds, in addition to eight species of mammals, were introduced in the Province of Pinar del Rio, Cuba, in late 1931. They were brought from Mexico, and are said to have included tinamous, guans, Ocellated Turkey, a thicknee, a wood rail (*Aramides*), Black-bellied Tree Duck and White-winged Dove. Except for the tree duck, which I am informed is well established and increasing in numbers in Pinar del Rio (Veiga-Azcune), these birds have evidently failed to become established in Cuba.

Hypothetical Records

When I prepared my "Check-List" I chose to ignore fantastic West Indian records, based in many instances on old, wrongly labeled specimens (e. g. there is an example of *Ara macao* from the "Greater Antilles" and one of *Cyanerpes cyaneus* from "Martinique" in the Academy's collection).

**ZOOLOGICAL RESULTS OF THE GEORGE VANDERBILT SUMATRAN
EXPEDITION, 1936-1939.* PART V.—MAMMALS COLLECTED
BY FREDERICK A. ULMER, JR. ON SUMATRA AND NIAS**

BY GERRIT S. MILLER, JR.

Associate in Biology, United States National Museum

INTRODUCTION

This paper gives the results of my study of the mammals that Mr. Frederick A. Ulmer, Jr. collected while a member of Mr. George Vanderbilt's second Sumatran expedition (middle of March to middle of June 1939). Mr. Ulmer worked chiefly in the southern part of the province of Atjeh, north to Blankedjeren (a little north of the latitude of Mount Löser) but he also collected specimens in the provinces of Sumatra's East Coast and Tapanuli, as well as on the island of Nias.

Accounts of the Atjehan and East Coast collecting stations have already been published by Mr. Rudolph Meyer de Schauensee and Mr. Sydney Dillon Ripley in their article on the Birds of Atjeh (these Proceedings, vol. 91, 1939, pp. 311-368, May 23, 1940). The same writers have listed the birds collected by Mr. Ripley on Nias (Proceedings, vol. 91, 1939, pp. 399-413, May 24, 1940) and have mentioned by name 4 of the mammals, *Macaca phaeura*, *Rattus maerens*, *R. barussanus*, and *Arctictis niasensis*, taken there by Mr. Ulmer. From the narrative given by Mr. de Schauensee and Mr. Ripley (1939, pp. 311-316) I have abstracted, for the purposes of this paper, the following outline of the expedition's itinerary:

March 17, 1939.—Field work began on the Labuan River half way between the port of Belawan Deli and the town of Medan, both situated in the province of Sumatra's East Coast.

March 20.—Motor trip from Medan to the central highlands around Brastagi (East Coast Province) and thence in a generally northward

* Parts I-III of this series appeared in vol. XCI, 1939 (1940), of these Proceedings as follows: Part I, Birds from Atjeh, by de Schauensee and Ripley; Part II, The Fishes, by Henry W. Fowler, pp. 369-398, May 24, 1940. Part III, Birds from Nias Island, by de Schauensee and Ripley; Part IV, The Reptiles, by J. Townsend Sackett, in *Notulae Naturae*, no. 41, March 4, 1940. Part I contains 9 plates (4 colored) and a map; Part II, 11 text-figures; Part III, 2 plates. Botanical collections are reported in *Notulae Naturae*, no. 47, May 31, 1940, *Botanical Results of the George Vanderbilt Sumatran Expedition, 1939*. Plants from Mt. Löser, by E. D. Merrill.

Geographical names in this paper follow the English spelling. In the other reports the Dutch spelling was used. Thus Agusan here = Agoesan; gunong = goenong, etc. The Expedition's route map is found in Part I. (Editor.)

direction to Kuta Tjane (alt. about 500 ft.) in Atjeh, Sumatra's most northerly province. Immediately around this town there are many rice fields and coconut palms. In May, on the return trip a good deal of collecting was done in this neighborhood, mostly at a distance from the town in places where there was much mixed original and secondary forest. From Kuta Tjane the motor road continues 20 km. to the base of Gunong [Mount] Shaitan (900 ft.). Beyond this point horses must be used; the valley of the Alas narrows and the forest growth is mainly original rain forest. Along the valley 24 km. farther on lies the village of Meluwak (2,100 ft.). Here the trees are very large, often about 250 feet high, and the transition from lowland fauna to highland fauna takes place.

After 4 days in Meluwak the party moved along the valley 24 km. to Kungke (3,100 feet) where there are many durian trees and where orang-utangs are common.

From Kungke the road continues through the Alas valley for about 8 km. and then northeasterly for 10 km. to Agusan (4,900 ft.), and to Blangkedjeren¹ (15 km. farther on) lying in a valley (2,900 ft.) the bottom of which is covered with ricefields. Here the landscape is park-like and there is a complete absence of the jungle that is so dense in the Alas valley.

On March 28 the party moved 20 km. westward to Blangnanga (3,700 ft.), on a bluff overlooking the Tripa River. Here it remained for 9 days, working at altitudes ranging from 3,500 to 4,700 ft.

From Blangnanga the trail ascended very steeply to 7,900 ft., where Bivouac No. 1 was made. At 6,500 ft. the change was very noticeable from foothill jungle to moss forest, with trees averaging only 15 to 40 feet in height, very hard, knotted and twisted. Everywhere the ground and the branches of the trees were covered with a deep carpet of moss and ferns. From Bivouac No. 1 the trail passed over a narrow 9,000 foot ridge to Bivouac No. 2 deep in the forest at 6,900 ft.

On the third day the base camp Blangbeke was reached. This camp was situated on a flat heathy plateau whose surface had an average elevation of about 7,000 ft.; surface of the "blang" mostly bare or covered with grass interspersed with patches of bushes and low trees. Thence to the top of Mount Löser conditions were virtually uniform. The party now proceeded by a series of "bivouacs" until on May 6 it made the ascent of Mount Löser's peak no. 1. This peak lies northeast of peak no. 2, to which it is connected by a long ridge; the altimeter reading on peak no. 1 was 10,300 ft. Peak no. 2 is probably 200 feet higher. On May 11 the party

¹ "*Blang*" is a word in the language of the Gajos, the people inhabiting the central highlands of Atjeh. It means 'open place' or 'clearing', as opposed to thick jungle. High in the mountains these grassy meadows are numerous. They are similar to the 'balds' in the Great Smoky Mountains in Tennessee; and the surrounding tangles of rhododendron increase this resemblance. The native radjas are called 'kedjuruns', and thus the village of Blangkedjeren and its grassy valley are actually 'the radja's clearing'." (Letter from Mr. Ulmer, April 22, 1940; for appearance of a "blang" see Pl. 6, fig. 6.)

returned to Blangkedjeren; and by May 18 collecting was finished and the entire party was once more in Medan. The expedition was then officially over, except that Mr. Ripley and Mr. Ulmer visited Tapanuli Bay (May 31-June 2) and the island of Nias (June 5-13) while final arrangements were being made for the homeward voyage.

The collection of mammals made during this expedition numbers 240 specimens pertaining to 66 species, three of which, *Callosciurus nigrovittatus*, *C. vittatus*, and *Rattus rajah*, are represented by two subspecies each. The total number of recognized forms is therefore 69, of which six, belonging to the genera *Presbytis*, *Hylobates*, *Callosciurus*, and *Rattus*, are here described as new. This material is of particular interest because the mammal fauna of Sumatra's highland districts has hitherto been practically unrepresented in American museums.

1. *Echinosorex gymnurus gymnurus* (Raffles)

Viverra gymnura Raffles, Trans. Linn. Soc. London, vol. 13, p. 272, 1821 (Type locality, Sumatra, near Benkulen).

Echinosorex gymnurus Cabrera, Genera Mammalium, Madrid, p. 58, 1925.

Echino-Sorex gymnurus gymnurus Chasen, Handlist, p. 11, April 1940.

20371, ♀ imm., Kuta Tjane, Atjeh (600 ft.); large upper premolar beginning to pierce maxillary bone. Head and body, 297; tail, 241, hind foot with claws, 57; ear from crown, 22. Skull, condylobasal length, 168; zygomatic breadth, 31; breadth of braincase at roots of zygomatics, 22; depth of braincase (median), 16; mandible (from articular process), 51; depth of mandible at middle of m_2 , 6.4; maxillary tooththrow (alveoli), 38.6; mandibular tooththrow (alveoli) 33.4; weight, 11.2 oz.

The specimen shows no peculiarities. "Captured alive by natives near Kuta Tjane. Had a very offensive odor. The Malays call this animal 'Tikus bulan' (= moon rat)." This quotation and others of the same kind are taken from Mr. Ulmer's field notes.

2. *Hylomys suillus maxi* Sody

Hylomys suillus maxi Sody, Ann. and Mag. Nat. Hist., ser. 10, vol. 12, p. 438, October 1933 (Type locality, Giesting, Lampungs, southeast Sumatra); Chasen, Handlist, p. 12, April 1940.

20372, ♀ ad. Blangnanga, Atjeh (3,600 ft.); $126.5 \times 17.5 \times 26.5 \times 10$. Wt. 1.9 oz.

20373, ♀ ad. Blangbeke, Atjeh (7,000 ft.); $123 \times 21 \times 26 \times 15$. Wt. 1.6 oz.

20374, ♀ ad. Blangbeke, Atjeh (7,000 ft.); $111 \times 23 \times 26 \times 14.5$. Wt. 1.1 oz.

20375, ♀ imm. Blangbeke, Atjeh (7,000 ft.); $94 \times 21 \times 25 \times 13$. Wt. 0.8 oz.

20376, ♀ ad. Blangbeke, Atjeh (7,000 ft.); $117 \times 22 \times 25.5 \times 14$. Wt. 1.5 oz.

20377, ♂ ad. Blangbeke, Atjeh (6,800 ft.); $128 \times 22 \times 27 \times 14$. Wt. 1.9 oz.

20378, ♂ juv. Blangbeke, Atjeh (7,000 ft.); $92.5 \times 17.5 \times 24.5 \times 13$. Wt. 1 oz.

20379 ♂ ad. Bivouac 5 (7,900 ft.); $123 \times 21 \times 26 \times 15$.

20380, ♀ ad. Bivouac 5 (7,900 ft.); $122.5 \times 20.5 \times 25.5 \times 15$. Wt. 1.5 oz.

20381, ♀ ad. Bivouac 5 (7,900 ft.); $122.5 \times 21.5 \times 26.5 \times 17$. Wt. 1.4 oz.

20382, ♂ ad. Bivouac 5 (7,900 ft.); $126 \times 22 \times 27.5 \times 16$. Wt. 1.5 oz.

The skins are very uniform in color. In most of them the pale band on the hairs of the back and sides is less distinctly tawny than in a skin of *H. suillus suillus* from Mt. Gedé, Java (no. 155,660, U. S. National Museum, September 27, 1909, William Palmer). Only four (nos. 20372, 20373, 20379 and 20380) show faint, scarcely noticeable traces of the pale area on under side of tail that is conspicuously developed in this Javan skin and is said to be characteristic of the *Hylomys parvus* described in 1916 by Robinson and Kloss (Journ. Str. Br. R. Asiat. Soc., no. 73, p. 438, July 1916) on the basis of 20 specimens taken on Mount Korinchi, Sumatra, about 500 miles southeast of Mount Löser. In the seven other skins the entire tail is uniformly blackish both above and below. The color of the tail is not mentioned in the original description of *Hylomys suillus maxi*.

The *Hylomys* skulls in the Atjeh series show little variation apart from size. In female no. 20372, taken at Blangnanga base camp the skull differs from all the others in the less attenuation of its rostrum (a peculiarity that is noticeable in both dorsal, lateral and ventral views of the skull) and in the larger size of its cheekteeth. This specimen is equally peculiar in the unusually slight attenuation of its rostrum and the greater breadth of its interorbital region. All the Sumatran skulls differ from the one Javan skull in the United States National Museum in their wider, deeper braincase and more robust mandibular ramus.

Measurements of six skulls of *Hylomys* (in millimeters)

Number	Sex	Greatest length	Zygomatic breadth	Breadth of braincase	Breadth of rostrum at front of pm ¹	Depth of rostrum at front of pm ²	Depth of braincase at middle	Length of nasal (median)	Mandible	Maxillary tooththrow (alv.)	Mandibular tooththrow (alv.)	Teeth	much worn
20377	♂	36.0	19.4	14.6	5.4	3.6	9.6	11.0	27.0	18.8	16.4	"	slightly "
20379	♂	35.0	17.8	14.2	5.0	3.6	9.4	10.8	26.0	18.0	16.0	"	" "
20382	♂	35.0	17.2	14.4	5.2	3.6	9.6	13.0	26.0	18.4	16.2	"	" "
20372	♀	33.8	18.6	14.6	6.4	3.4	9.4	9.8	24.0	17.0	15.6	"	" "
20374	♀	33.4	17.0	14.0	5.0	3.0	9.2	9.8	24.0	18.0	15.8	"	not "
20380	♀	33.6	16.8	14.4	4.8	3.0	9.0	12.0	24.2	17.4	15.4	"	slightly "

The cranial measurements of the Atjehan specimens are essentially the same as those that Robinson and Kloss recorded for their series of *Hylomys suillus parvus* from Sungei Kumbang (4,700 ft.) and Sungei Kring (7,300 ft.) in the Korinchi region (Journ. Fed. Malay States Mus., Singapore, vol. 8, p. 25, June 1918). They also closely agree with those recorded by Sody for the imperfect type specimen of *H. suillus maxi* from Geistings, Lampungs, southeast Sumatra, a locality that I have not been able to find on any map, but one that is unlikely to be of any considerable altitude in a province whose surface is mostly low. For the present the status of the two described Sumatran forms and that of the animal from Atjeh must remain "subject to revision."

"Although we captured a specimen (♀ no. 20372) at Blangnanga Base Camp, altitude 3,600 ft., this animal seemed to be most abundant in the heavy moss forest at altitudes ranging from 6,800 ft. to 7,900 ft. One was seen at 9,300 ft. near Bivouac No. 7. The fact that several individuals were infested with fly larvae when taken from the traps in the early morning leads me to believe that they were diurnally active and that they had been killed during the previous day. They are voracious, often devouring the entire bait (ham rind, coconut meat, walnuts) before springing the trap. One partly devoured the chicken-head bait of a steel trap before getting caught in a nearby Schuyler trap baited with ham rind. Stomachs usually contained the chewed remains of earthworms; also bits of moss accidentally taken in. Most individuals had what appeared to be sores at the base of the tail. All had a very strong porcine odor. Native name 'tikus kechil' (= small rat)."

3. *Tupaia javanica occidentalis* Robinson and Kloss

Tupaia javanica occidentalis Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, p. 16, June 1918 (Type locality, Penoh River, Korinchi Valley, Sumatra, alt. 2,600 ft.); Chasen, Handlist, p. 5, April 1940.

20363, ♂ imm. Kungke (3,000 ft.); $137 \times 160 \times 36$ (34) $\times$ 6. Wt. 2.6 oz.

20364, ♀ ad. Blangnanga (3,600 ft.); $141 \times 161 \times 37$ (34.6) $\times$ 7. Wt.

3 oz.

20366, ♀ ad. Blangnanga (3,600 ft.); $139 \times 159 \times 36$ (34) $\times$ 8. Wt. 2.5 oz.

20367, ♂ ad. Meluwak (1,500 ft.); $164 \times 172 \times 38.4$ (36).

20368, ♂ ad. Medan, near Deli; $138 \times 164 \times 36$ (34) $\times$ 8. Wt. 2.6 oz.

20369, ♀ ad. Sibolga (300 ft.); $143 \times 188 \times 36$ (34) $\times$ 7. Wt. 3.1 oz.

The 6 Sumatran skins as compared with 14 Javan specimens of *T. javanica javanica* in the United States National Museum differ (a) in their uniformly paler dorsal coloration (back about like that of the palest Javan specimens, such as no. 257591, U.S.N.M., from Gunong Salak, Western Java, and no. 121492, U.S.N.M., no exact locality), (b) in the less evident

buffy suffusion of the under parts, (c) in the usually less noticeable darkening of the tail (as compared with the back).

In color the skins are very uniform except that the under parts of no. 20367, from Meluwak (1,500 ft.) are rather heavily suffused with tawny-ochraceous. The two females from Blangnanga (3,600 ft.), nos. 20364 and 20366, appear to differ in no essential way from the female taken at Sibolga, near Tapanuli Bay (300 ft.) or from the male taken near Medan (not far from sea level) on the opposite side of the island.

The specimen (no. 20367) from Meluwak (1,500 ft.), with its strongly tawny-ochraceous under parts, differs rather noticeably from all the others. Its skull and teeth, however, show no peculiarities. Skulls of no. 20367 (Meluwak, 1,500 ft., teeth slightly worn) and of no. 20364 (Blangnanga, 3,600 ft., teeth moderately worn): greatest length, 42.4 (42.0); zygomatic breadth, $22\pm$ (22.2); interorbital breadth at lacrimal level, 13.2 (13.0); palatal length (median), 22.0 (22.0) palatal breadth including molars, 13.4 (13.4); mandible, 28.0 (28.2); upper toothrow (alveoli), 21.0 (20.6); lower toothrow (alveoli), 16.4 (16.4).

4. *Tupaia glis jacki* Robinson and Kloss

Tupaia glis jacki Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, p. 15, June 1918 (Type locality, Siolak Daras, Korinchi Valley, Sumatra); Chasen Handlist, p. 2, April 1940.

20365, ♂ juv. Blangnanga (3,600 ft.); $172 \times 157 \times 44 \times 7.5$ Wt. 3.2 oz.

20370, ♂ ad. Meluwak (1,500 ft.); $195 \times 150 \times 43.5$ (41) $\times$ —.

Skull of the adult (teeth slightly worn); greatest length, 51.2; condylo-basal length, 47.4; zygomatic breadth, $25\pm$; breadth of braincase, 20.0; breadth of rostrum at front of first premolar, 7.6; depth of rostrum at front of first premolar, 5.6; depth of braincase at middle, 14.4; length of nasal, $18\pm$; mandible, 34.6; maxillary toothrow (alveoli), 26.5; mandibular toothrow (alveoli), 21.0.

These two specimens, together with 10 in the United States National Museum from other parts of Sumatra, differ from the 36 skins collected by Abbott on the Malay Peninsula in the manner indicated by Robinson and Kloss when they described their material from Korinchi. The general color of the back is darker (more ferruginous) than in the mainland skins, and the variegation produced by the pale bands on the hairs of the upper parts tends to be less noticeable. In these Sumatran animals the under side of the tail is usually tinged with buff. Apparently it is never a clear grizzled gray like that seen in all but three of the 36 mainland specimens (U. S. N. M. nos. 112,577 and 112,662 from Johore and 105,034 U. S. N. M. from Tringanu), though in three Sumatran skins (U. S. N. M. nos. 114,152, 114,153 from Loh Sidoh Bay, extreme northwest Sumatra and 114,548 from Tapanuli Bay, West Sumatra) there is a very near approach to the color usual on the Peninsula. In several of the Sumatran specimens (no. 20370 A. N.

S. P. from Meluwak, nos. 143,333 and 143,336 U. S. N. M., from Aru Bay, no. 267,401 U. S. N. M., from Kuala Simpang, Atjeh, and in no. 267,678 U. S. N. M. from "Atjeh" purchased alive in Siantar) there is an evident tendency for the grizzling to disappear along the median region of the tail's under surface. This tendency is especially well marked on the distal half of the tail in the Meluwak specimen (no. 20370 A. N. S. P.) and on the entire under side of the tail in no. 143,333 U. S. N. M. from Aru Bay and 267,401 U. S. N. M. from Kuala Simpang, Atjeh. Its extension would lead to the coloring seen in Dr. Lyon's *Tupaia siaca* from Little Siak River, eastern Sumatra, in which the entire under side of the tail is a clear tawny-ochraceous except for a sprinkling of blackish hairs along the midrib (represented by 7 specimens in the United States National Museum; no marked variation in the color of the tail). Four skins from Perlak, Atjeh, a locality on the coast about 330 miles northeast of Little Siak River (nos. 257,593-6 U. S. N. M.; received from Mr. H. J. V. Sody and determined by him as *Tupaia glis phaeniura* Thomas, type locality Deli, near Aru Bay, northwest Sumatra) have tails essentially like those of the Siak form, except that the tawny-ochraceous is replaced by pale buff. The general appearance of these specimens is such as to suggest that they were originally preserved in some kind of fluid that might have altered their color.

On comparison of 12 Sumatran skulls with a like number from the Malay Peninsula I can find no characters to distinguish the two series. The greatest length in the two largest Sumatran skulls (no. 141,074 U. S. N. M., adult male from Tarussan Bay, and no. 143,335 U. S. N. M., adult female from Aru Bay) is 52.6, while in the two largest Peninsular specimens (no. 105,025, adult male from Tanjong Dungan, Tringanu, and no. 112,579, adult male from the Endau River, Johore) it is 52.0 and 53.0 respectively.

The Sumatran tree-shrews of the *Tupaia glis* group differ conspicuously from those of the Malay Peninsula in their tendency to develop local forms distinguished by the coloring of the tail. On the Peninsula the under side of the tail is, almost without exception, a clear, finely grizzled gray. On Sumatra grizzled tails appear still to be the rule (*T. glis jacki* Robinson and Kloss); but in several localities the grizzling has been replaced by clear orange or buff. This process has given rise to the forms that have received the names *Tupaia ferruginea demissa* Thomas (in Schneider, Zool. Anzeiger, vol. 27, p. 723, July 12, 1904, figured by Schneider, Zool. Jahrb., Syst., vol. 23, pl. 2, 1905) from Langkat, northeastern Sumatra, *Tupaia siaca* Lyon, 1904 (Proc. U. S. Nat. Mus., vol. 34, p. 661, September 14, 1908) from Little Siak River, east central Sumatra, and *Tupaia glis phaeniura* Thomas, 1927, from Deli, northeast Sumatra. To these will have to be added the form represented by specimens (in the United States National Museum) collected at Perlak by Mr. Sody, if the coloring of these skins proves to be normal.

"Tree-shrews (both species) were inconspicuous animals on the trunks and among the branches of the huge jungle trees. They were usually seen high in the tree-tops, though no. 20365 (*T. g. jacki*) was trapped on the ground in a jungle-filled ravine near Blangnanga. I noticed this 'tupai tana' (the native name, meaning 'ground squirrel') near a trap baited with cocoanut. When I rebaited this trap with meat I soon caught the tree-shrew. Above 4,000 ft. we did not see any of these animals."

5. *Pteropus vampyrus malaccensis* K. Andersen

Pteropus vampyrus malaccensis K. Andersen, Ann. and Mag. Nat. Hist., ser. 8, vol. 2, p. 368, October 1908 (Type locality, Kuala Tembeling, Pahang, Malay Peninsula); Chasen, Handlist, p. 24, April 1940.

20383, ♂ ad. Between Meluwak and Gunong Shaitan; $323 \times \text{---} \times 59 \times 49$. Wingspread, 1393. Wt. 2 lbs. 8.8 oz. Forearm, 200.

20384, ♂ ad. Kuta Tjane (600 ft.); $302 \times \text{---} \times 66 \times 47$. Forearm, 194.

20385, ♂ ad. " " " $298 \times \text{---} \times 64 \times 46$.

20386, ♂ ad. " " " $297 \times \text{---} \times 56 \times 47$. Forearm, 190.

These are typical examples of the common large Sumatran fruit bat. They were all taken between Gunong Shaitan (900 ft.) and Meluwak (2,100 ft.).*

"In the low central valley between Kuta Tjane and Meluwak we saw many flying-foxes (called 'kalongs' by the natives). During the day they roosted by the hundreds in tall jungle trees (usually trees that were isolated from the surrounding growth) where, hanging inverted from the highest branches they looked like great tropical fruits. The bats were never quiet but were forever bickering over the best perches and occasionally uttering shrill screams. Even in bright sunlight a few were usually to be seen on the wing. At dusk they flew to their feeding places, usually some jungle trees fruiting or in blossom. They were very fond of the flowers of the durian tree (*Durio zibethinus*). Few flying-foxes were seen near Medan; probably because of the large population of Chinese who eat many of them. These bats are usually excessively fat. They have a very strong, unpleasant odor."

6. *Pteropus niadicus* Miller

Pteropus niadicus Miller, Proc. Biol. Soc. Washington, vol. 19, p. 64, May 1, 1906 (Type locality, Teliwaa, near mouth of Mojeia River, Nias).

Pteropus melanotis niadicus Chasen, Handlist, p. 24, April 1940.

20438, ♀ ad.; Hilisimaetano, southern Nias; $250 \times \text{---} \times 49 \times 22$. Wingspread, 1117; forearm, 156; greatest length of skull, 170.0; zygomatic breadth, 36.2; mandible, 55.5; maxillary toothrow, exclusive of incisors (alveoli), 27.0. Wt. 19.3 oz.

This specimen represents the pale phase, in which the clear buffy-gray back is strongly contrasted with the snuff brown mantle. In color it closely resembles the type of the larger *Pteropus hypomelanus lepidus* (Miller) from the Tambelan Islands off the west coast of the Malay Peninsula, and

* Ulmer gives the altitude of Meluwak where his collections were made as 1,600 feet, and henceforth this altitude will be used for his specimens.

strongly contrasts with the three original skins of *P. niadicus* (collected by Abbot at Teliwaa and Gunong Sembru, Nias) all of which are in the dark-backed color phase. The skull and teeth do not differ from those of the type specimen in any significant way.

"Flying-foxes were very numerous near Hilisimaetano. Many roosted in a 200 ft. tree not far from the village. At dusk they became active and often filled the sky to great heights as they moved away to their feeding grounds. While feeding they usually scattered. One common tree was in blossom at the time, and the 'kalongs' fed freely on its red flowers. These bats displayed their greatest activity during the early part of the night. In the rays of a head lamp their eyes shone bright red."

7. *Cynopterus brachyotis brachyotis* (S. Müller)

Pachysoma brachyotis S. Müller, Tijds. Nat. Geschied. en physiol., Amsterdam, vol. 5, pt. 1, p. 146, 1838 (Type locality, Dewei River, Borneo).

Cynopterus brachyotis brachyotis Andersen, Catal. Chiropt. Brit. Mus., vol. 1, p. 614, March 23, 1912; Chasen, Handlist, p. 25, April 1940.

20387, ♂ ad. (skull broken); Blangbeke Dua (3700 ft.), Atjeh, $96 \times 6 \times 14.5 \times 16$. Wingspread, 381.

20388, ♀ ad. (skull broken); between Kungke (3000 ft.) and Meluwak (1600 ft.), $92 \times \text{---} \times 12 \times 16$. Wingspread, 351. Wt. 0.8 oz.

20392, ♀ ad. (skull broken); Meluwak (1600 ft.) $76 \times 7 \times 18 \times 17$.

20394, ♀ juv. Deli, Medan (near sea level); $96 \times \text{---} \times 15 \times 16.5$. Wingspread, 380. Wt. 1.1 oz.

20395, ♀ ad. Deli, Medan; $91 \times 15 \times 15 \times 15$. Wingspread, 422. Skull, greatest length, 29.4. Wt. 1.3 oz.

20396, ♂ ad. Pulo Kelapa, Tapanuli Bay; $105 \times 13 \times 17.5 \times 18$. Wingspread, 450. Wt. 1.9 oz.

20397, ♀ ad. Pulo Kelapa, Tapanuli Bay; $101 \times 12 \times 17.5 \times 16$. Wingspread, 409. Wt. 2 oz.

20398, ♂ ad. Pulo Kelapa, Tapanuli Bay; $101 \times 13 \times 18 \times 19$. Wingspread, 445. Wt. 1.8 oz.

20399, ♂ juv. Pulo Kelapa, Tapanuli Bay; $89 \times 13 \times 17 \times 16$. Wingspread, 402. Wt. 1.1 oz.

20400, ♀ ad. Pulo Kelapa, Tapanuli Bay; $103 \times 14 \times 16 \times 16$. Wingspread, 420. Wt. 1.9 oz. Large embryo.

20401, ♀ ad. Pulo Kelapa, Tapanuli Bay; $104 \times 13 \times 17.5 \times 19$. Wingspread, 456. Wt. 1.6 oz.

Altitudinal range from sea level or near it, at Deli, not far from the northeast coast, and Kelapa Island, Tapanuli Bay, on the southwest coast, up to 3,700 ft. at Blangbeke Dua, Atjeh. The skin from Blangbeke Dua (♂ ad. no. 20387) is slightly darker in color than the others, and its fur has a peculiar woolly texture. It is marked "from alcohol." Skull and teeth normal.

"These small fruit-bats were numerous around Medan where they fed on blossoms and soft fruits. They usually appeared shortly after dark and

made little noise. Sometimes they landed on a branch but just as often they hovered in front of a spray of flowers as a humming-bird does, their wings a blur. Their eyes gleamed greenish yellow in the head-lamp beam.

"Near Sibolga some *Cynopterus* roosted in a small cave on an island in Tapanuli Bay. At dusk these bats would fly over to the town to feed on fruit in the gardens. They were particularly fond of sapodillas (*Sapota*). When I entered the cave the bats took alarm and flew out into the bright sunlight that seemed not to inconvenience them."

8. *Cynopterus horsfieldi lyoni* Andersen

Niadias [sic] *minor* Lyon, Proc. U. S. Nat. Mus., vol. 34, p. 665, September 14, 1908 (Type locality, confluence of Gasip and Siak Rivers, East Sumatra). Not *Cynopterus minor* Trouessart, 1878, a member of the same genus.

Cynopterus horsfieldi lyoni Andersen, Catal. Chiropt. Brit. Mus., vol. 1, p. 827, March 23, 1912; Chasen, Handlist, p. 26, April 1940.

20389, ♀ ad. Meluwak, Atjeh (1,600 ft.); $98 \times 11 \times 21 \times 24$. Skull, greatest length, 34.6.

20390, ♀ ad. Meluwak, Atjeh (1,600 ft.); $106 \times 10 \times 19 \times 22$. Skull, greatest length, 33.4.

20391, ♂ juv. Meluwak, Atjeh (1,600 ft.); $60 \times 11 \times 17 \times 18$. Skull, greatest length, 25.0.

20393, ♀ ad. Meluwak, Atjeh (1,600 ft.); $103 \times 12 \times 18 \times 22$. Skull, greatest length, $33.4 \pm$.

Type specimen (U. S. N. M. no. 144,264); $100 \times 8 \times 17 \times 16 \pm$ (alc.). Skull, greatest length, 32.3.

9. *Rhinolophus luctus* Temminck

Rhinolophus luctus Temminck, Monogr. Mamm., no. 8, p. 24, pl. 19, 1935 (Type locality, Tapos, Java).

Rhinolophus luctus luctus Chasen, Handlist, p. 40, April 1940.

20402, ♀ ad. Sibolga, Tapanuli; $89 \times 52 \times 19.5 \times 32$. Wingspread, 439. Forearm, 68.5; tibia, 35.4; foot (dry), 16.6; 3d metacarpal, 46. Skull, greatest length, 32.0; condyloincisive length, 28.6; zygomatic breadth, 16.0; rostral breadth across roots of canines, 9.0; breadth of braincase above roots of zygomata, 12.0; interorbital constriction, 2.0; greatest height of sagittal crest, 3.0; mandible, 22.0; maxillary tooththrow (crowns), 11.2; mandibular tooththrow (exclusive of incisors), 13.0. Wt. 3.6 oz.

In the absence of specimens from Java, the type locality of *Rhinolophus luctus luctus*, it is not possible to determine the exact identity of this specimen. Mr. Chasen (Handlist, p. 40) records the occurrence of both the typical subspecies and *R. luctus morio* (Gray) in Sumatra.

"Shot at night hanging from bare branch of low tree."

10. *Hipposideros larvatus neglectus* Sody

Hipposideros larvatus neglectus Sody, Natuur. Tijdschr. Ned. Ind., vol. 96, p. 46, 1936 (Type locality, Mt. Kenepai, Dutch Central Borneo); Chasen, Handlist, p. 46, April 1940 (range extended to Nias).

20441, ♀ ad. Hilisimaetano, southeastern Nias; $65 \times 33 \times 12 \times 17$. Wingspread, 341. Forearm, 57; tibia, 20.6. Skull (measurements in parentheses are those of a Javan specimen of true *H. larvatus*, ♀ no. 155,813 U.S.N.M., Pelabuan Ratu, collected by William Palmer): occipito-canine length, 21.5 (21.0); zygomatic breadth, 12.8 (12.4); rostral breadth across roots of canines, 6.0 (6.0); breadth of braincase above roots of zygomata, 9.6 (8.6); rostral breadth across roots of canines, 6.0 (6.0); interorbital constriction, 3.0 (3.0); greatest height of sagittal crest, $1.0 \pm (1.0 \pm)$; greatest depth of skull above flat surface, 9.5 (10.0); ratio of greatest depth to occipito-canine length, 44.1 (47.6), mandible, 15.4 (15.2); maxillary tooththrow (crowns), 9.0 (8.8); mandibular tooththrow (crowns), 9.6 (9.8). Wt. 0.6 oz.

The skin and skull of the *Hipposideros larvatus* that occurs on Nias appears to represent a form that is readily separable from true (Javan) *larvatus* by the shape of its skull and by the darker, less contrasted color of both the hair tips and the underfur. Not improbably this bat is distinct from the Peninsular forms as well; but the material now at hand is not sufficient to prove this point. The skull differs from that of the Javan animal in the more elongated, less highly and abruptly arched form of its braincase. It thus agrees in form with specimens from Trong, Lower Siam, no. 84,392 U. S. N. M., and the Natuna Islands, Sirhassen, no. 104,749 U. S. N. M., as well as with skulls from Pangkallahan River, S. E. Borneo (all collected by Abbott) of the larger *H. larvatus neglectus* Sody, Natuur. Tijdschr. Ned. India, Batavia, vol. 96, p. 46, 1936 (type from Mt. Kenepai, Dutch Central Borneo), two "unusually large" specimens of which are recorded from "South Sumatra" by Mr. Sody, p. 47, while Mr. Chasen, Handlist, p. 46, adds "Nias Island" to its range.

"One of the bats brought in by natives who refused to tell us where they found them."

11. *Hipposideros diadema vicarius* Andersen

Hipposideros diadema vicarius Andersen, Ann. and Mag. Nat. Hist., ser. 7, vol. 16, p. 499, November 1905 (Type locality, Niah Cave, Sarawak, Borneo; range, north Borneo, south Celebes, Sumatra); Chasen, Handlist, p. 42, April 1940.

20442, ♀ ad. Hilisimaetano, Nias; $93 \times 44 \times 15 \times 25$. Wingspread, 470. Forearm, 76 ("80.5-85.2");² tibia, 33.0; foot (dry), 15.0; third metacarpal, 57.3. Greatest length of skull, 30.6; zygomatic breadth, 17.0; rostral breadth across roots of canines, 8.4; interorbital constriction, 3.6; greatest height of sagittal crest, 2.0; mandible, 11.4; maxillary tooththrow (crowns), 11.8 ("12.1-13.2").² Wt. 1.2 oz.

The large *Hipposideros* brought to Mr. Ulmer by natives has a forearm 3.5 mm. shorter than in any of the eight examined by Andersen; the length of its upper tooththrow falls 0.3 mm. below Andersen's minimum. These slight differences do not appear to be of much importance.

² Measurements in parenthesis are the extremes of 8 specimens recorded by Andersen.

"One of the bats brought in by natives who refused to tell us where they found them."

12. *Hipposideros gentilis major* Andersen

Hipposideros gentilis major Andersen, Ann. and Mag. Nat. Hist., ser. 7, vol. 2, p. 380, October 1918 (Type locality, Bua-Bua, Engano Island, off southwestern Sumatra; another specimen recorded from Nias); Chasen, Handlist, p. 45, April 1940.

20443, ♀ ad., Hilisimaetano, Nias; $52.5 \times 25.5 \times 9 \times 13$. Wingspread, 282. Forearm, 45.6; tibia, 17.4; foot (dry), 7.2. Greatest length of skull, 17.6; condylo-canine length, 15.0; zygomatic breadth, 9.8; rostral breadth across roots of canines, 5.0; greatest breadth of braincase, 9.0; interorbital constriction, 3.0; greatest height of sagittal crest, 1.0; mandible, 11.0; maxillary toothrow, 6.0; mandibular toothrow exclusive of incisors, 6.4. Wt., 0.35 oz.

"Brought in by natives who, as usual, refused to give information as to where or how the bat had been caught."

13. *Emballonura monticola* Temminck

Emballonura monticola Temminck, Tijdschr. Nat. Gesch. en Physiol., vol. 5, p. 25, 1838 (Type locality, Java).

Emballonura monticola monticola Chasen, Handlist, p. 31, April 1940.

20444, ♀ ad., Soliga, Nias; $45.5 \times 12 \times 8.5 \times 10$ (tragus, 3.5). Wingspread, 268. Forearm, 40.4; tibia, 17.6; foot (dry), 7.4; greatest length of skull, 13.2; zygomatic breadth, 8.2; greatest breadth of rostrum, 5.4; breadth of braincase above roots of zygomatica, 6.6; mandible, 9.2; maxillary toothrow (crowns), 5.0; mandibular toothrow (crowns), 6.0. Wt., 0.4 oz.

20445, ♀ ad., Soliga, Nias; $49 \times 12 \times 8 \times 10$ (tragus, 3.0). Wingspread, 264. Forearm, 40.0; tibia, 14.0; foot, 7.0; greatest length of skull, 14.0; zygomatic breadth, 7.0; greatest breadth of rostrum, 5.6; greatest breadth of braincase, 7.0; mandible, 8.8. Wt., 0.35 oz.

In both specimens the rostral portion of the skull is slightly less broad as compared with the braincase than it is in one (no. 143,321 U.S.N.M.) from Aru Bay, northeast Sumatra, and another (no. 114,276 U.S.N.M.) from Pulo Babi, 17 miles southeast of Simalur Island off the coast of southwest Sumatra. I have not been able to compare the Sumatran material with topotypes from Java.

14. *Myotis niasensis* Lyon

Myotis niasensis Lyon, Proc. U. S. Nat. Mus., vol. 52, p. 441, December 30, 1916 (Type locality, Siaba Bay, Nias).

Myotis muricola niasensis Chasen, Handlist, p. 49, April 1940.

20439, ♂ ad., Hilisimaetano, Nias; $43 \times 35 \times 8 \times 8$ (tragus, 6.0). Wingspread, 232. Forearm, 31.5; tibia, 15.6; foot (dry), 6.6; 3d metacarpal, 30.5; greatest length of skull, 13.5; zygomatic breadth, 9.4; breadth of braincase above roots of zygomatica, 16.2; interorbital constriction, 3.4; mandible, 9.6; upper canine to m^3 , 5.0; lower canine to m_3 , 5.5.

20440, ♂ ad., Hilisimaetano, Nias; $45 \times 37 \times 7.5 \times 12$ (tragus, 6.5). Wingspread, 228. Forearm, 32.0; tibia, 16.0; foot (dry), 7.0; 3d metacarpal,

29.2; greatest length of skull, 13.0; zygomatic breadth, 9.0; interorbital constriction, 3.0; breadth of braincase above roots of zygomata, 6.0; mandible, 10.0; maxillary tooththrow (crowns), 5.0; mandibular tooththrow (crowns), 5.5.

The color of these two skins agrees with that described by Dr. Lyon in the original account of the species except that the chin is not obviously paler than the rest of the ventral surface. The skulls are in every way similar to the skull of the type.

15. *Helarctos malayanus* (Raffles)

Ursus malayanus Raffles, Trans. Linn. Soc. London, vol. 13, p. 254, 1821 (Type locality, near Benkulen, Sumatra).

Helarctos malayanus Horsfield, Zool. Journ., vol. 2, p. 234, April 1825.

Helarctus malayanus malayanus Chasen, Handlist, p. 89, April 1940.

20235, ♀ ad. (molars beginning to wear; all cranial sutures closed except at sides of nasals and along anterior 7 mm. of median nasal suture), between Blangkedjeren and Agusan, Atjeh. No external measurements. Greatest length of skull, 216; condylobasal length, 206; zygomatic breadth, 177; interorbital breadth, 61.6; postorbital breadth, 63.0; mastoid breadth, 135.6; mandible, 145; maxillary tooththrow (alveoli), 72.6; mandibular tooththrow (alveoli), 87.2. Mammae 4 (1-1 axillary, 1-1 pectoral).

"Sun bears were numerous in the lower hill jungles of Atjeh. The single specimen collected was one of three shot by a Chinese hunter between Blangkedjeren and Agusan in primeval rain-forest. Unfortunately the Malay who skinned the animals did not salt them properly and we were forced to discard two.

"Near Meluwak I saw the tracks of a 'bruang' where it crossed the trail; the animal's long claws left unmistakable marks in the soft earth.

"We found tracks of a sun bear near Blangbeke at an elevation of 7,000 ft. At 6,500 ft., on a well-wooded ridge south of Mount Löser, our native guides pointed out a decayed tree that had been clawed open, twenty feet above the ground by a bear in search of honey."

16. *Mustela nudipes nudipes* Lesson

Furet de Java Geoffroy-Saint-Hilaire and F. Cuvier, Hist. Nat. Mammif., vol. 3, livr. 32, art. Furet de Java, p. 2, 1821. Binomial *Putorius nudipes* C.-F. Cuvier not published until 1842 (l. c., vol. 7, Table gén. et méth., p. 3).

Mustela nudipes Lesson, Man. de Mammalogie, p. 145, 1827. Based on the "furet de Java" of Geoffroy-Saint-Hilaire and F. Cuvier, 1821, actually from Sumatra (probably near Benkulen), as the animal is unknown in Java.

Mustela nudipes nudipes Chasen, Handlist, p. 90, April 1940.

20233, ♂ imm. (basal and rostral sutures of skull open and left milk pm₃ in place). Head and body, 344; tail, 240; hind foot, 62; ear from crown, 15. Wt., 9.6 oz. Greatest length of skull, 61.4; zygomatic breadth, 32.5; mandible, 33.0; upper canine to m³ (crown), 18.2; lower canine to m₃ (crown), 21.2; baculum (chord), 46.0.

In color this specimen does not differ significantly from that of two Bornean skins collected by Abbott and now in the United States National Museum (nos. 151,878 from Tjantung, S. E. Borneo, collected by Abbott, and 269,062, no exact locality), representatives of the race to which Mr. Chasen (Bull. Raffles Mus., Singapore, no. 15, p. 91, April 1940) has recently applied the name *Mustela nudipes leucocephala* (Gray). At present there is not enough material at hand in Washington to permit any discussion of the Sumatran and Bornean animals' distinctness from each other. The single Bornean skull (♂, no. 151,878 U. S. N. M., Tjantung, S. E. Borneo), though fully adult (all sutures closed), is not so large as the immature Sumatran specimen (♂, no. 20233 A. N. S. P.): greatest length, Sumatran, juv., 61.4, and Bornean, ad., 61.2; zygomatic breadth, 32.5 and 32.8; mandible, 35.0 and 34.6; maxillary toothrow (crowns), 18.2 and 17.6. The posterior extension of the palate is slightly broader (7.6 instead of 7.0), and the auditory bullae are more inflated. In color the skins are practically identical, though the one from Borneo is slightly the darker of the two.

The baculum as compared with that of a mink from Virginia (no. 258,207 U. S. N. M.) is longer and more slender (greatest length in straight line 45 instead of 42.5, width at middle 1.5 instead of 3.0). The proximal end of the shaft is slightly and simply swollen, with no trace of the conspicuous bilobate expansion seen in the baculum of the mink. Groove on lower (urethral) surface extending back only 16 mm. from the end of the bone, the lower surface then becoming a simple ridge in strong contrast with the conditions present in the mink's baculum with its urethral groove conspicuous through the entire distal half of the bone and traceable proximally, almost to the beginning of the basal expansion, as a faint concavity extending along the bone's nearly flat under surface.

"The naked-footed weasel was captured alive by natives near Kuta Tjane. It behaved very much like an American weasel, drawing its head back in snake-like attitudes and holding its back highly arched. It was very active, nervously pacing the cage and looking at the spectator with its bright beady eyes. It paid no attention to chicken heads; but when small dead birds were offered it seized them in a lightning-quick motion, tore them to shreds and devoured them. The odor of the anal glands was very offensive, more so than in the American *Mustela noveboracensis*."

17. *Lutra lutra barang* (F. Cuvier)

Lutra barang F. Cuvier, Dict. Sci. Nat., Paris, vol. 27, p. 246, 1823 (Type locality, Sumatra; see Chasen, Handlist, p. 92, footnote, April 1940).

Lutra vulgaris barang Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, p. 13, June 1918.

Lutra lutra barang Chasen, Handlist, p. 92, April 1940.

20234, [♀?] immature, with basal and rostral sutures of skull open; permanent dentition fully in place; formerly mounted. Collected at Lake

Takengon (altitude 3,900 ft.) by Mr. W. F. E. Brouwer and presented by him to the Expedition.

Hind foot (relaxed), 89; hind foot without claws, 84. Skull: condylo-basal length, 91.5; zygomatic breadth, 50.8; mastoid breadth, 48.3; inter-orbital constriction, 16.4; palatal breadth including pm⁴, 28.7; breadth of rostrum including canines, 20.5; mandible, 56.6; upper tooththrow exclusive of incisor (alveoli), 30.6; lower tooththrow exclusive of incisors (alveoli), 36.6.

"A mounted specimen of the Sumatran otter was presented by Mr. Brouwer, of Blangkedjeren. At Kungke [3,100 ft.], on the Agusan River, a member of our party armed with only a .410 shotgun found five otters sunning themselves on a rock in the turbulent stream. As he approached, three of the animals slid off into the water. The two others flattened against the rock, and, although one of them was wounded badly, both disappeared in the rapid current."

18. *Arctonyx collaris hoevenii* (Hubrecht)

Trichomanis hoevenii Hubrecht, Notes Leyden Mus., vol. 13, p. 242, October 1891 (Type locality, mountains between Palembang and Benkulen, Sumatra).

Arctonyx collaris Hubrecht, Proc. Zool. Soc. London, 1895, p. 522.

Arctonyx hoeveni Schneider, Zool. Jahrb., Syst., vol. 23, pt. 1, p. 91, 1905.

Arctonyx collaris hoevenii Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, p. 11, June 1918; Chasen, Handlist, p. 91, April 1940.

20230, ♂ ? ad. (all cranial sutures closed, teeth much worn; Bivouac No. 5, altitude 8,000 ft. "Found in open blang, near trail." No measurements of skin.

20231, ♀ imm. (full milk dentition). Blangkedjeren, 2,900 ft.

20232, adult ♂ ? (no mammae visible on skin, formerly mounted) skin and skull, Kuta Tjane, 600 ft.

Measurements of skulls (no. 20230, teeth much worn, and no. 20232, teeth just beginning to wear: condylobasal length, 113.5 and 115.0; zygomatic breadth, 66.7 and 59.5; mastoid breadth, 62.8 and 55.2; interorbital constriction, 26.2 and 24.0; rostral breadth in front of canines, 15.6 and 15.0; mandible, 81.4 and 78.0; upper canine and cheekteeth, 39+ and 39.5; lower canine and cheekteeth, 46.2 and 47.0.

"Although two of our specimens were collected by natives at supposedly low elevations I saw definite evidence of hog badgers' presence in the mountains only. Their diggings were first seen at Bivouac No. 5 (7,900 ft.) where we found the skeleton of an aged animal. Some hair and cartilage were still adhering to the bones. Along a brook flowing thru a deep ravine the badgers had dug many funnel-shaped depressions two or three inches deep. A heavy steel trap set there (baited with the carcass of a little jungle squirrel, *Tomeutes*) caught one; but the powerful animal pulled free, leaving only a bunch of hair. At Bivouac No. 7 (9,300 ft.) a badger burrow was found in the bank of a stream that flowed through a large 'blang' or alpine meadow. This burrow was about 10 inches in diameter; a large

heap of debris had accumulated in front of it. In this area we saw the characteristic 'grubbings' of the badgers. Again, in a 'blang' between Bivouacs 8 and 9 the small funnel-shaped holes were so numerous as to pock the ground in all directions. Members of the expedition who kept the young badger (no. 20231) alive for a few days were in accord concerning the animal's foetid odor."

19. *Paradoxurus hermaphroditus musanga* (Raffles)

Viverra musanga Raffles, Trans. Linn. Soc. London, vol. 13, p. 252, 1821 (Type locality, near Benkulen, Sumatra).

P[aradoxurus] typus var. *sumatranus* J. B. Fischer, Syn. Mamm., p. 159, 1829 (Renaming of *musanga*).

Paradoxurus hermaphroditus musanga Chasen, Handlist, p. 96, April 1940.

20227, ♂ ad. Kuta Tjane (600 ft.); $535 \times 502 \times 91 \times 43$. Wt. 6 lbs.

20228, ♂ ad. Kuta Tjane (600 ft.); $546 \times 512 \times 87 \times 42$. Wt. 6 lbs.

Measurements of the skulls (teeth beginning to wear; rostral and cranial sutures not completely closed); condylobasal length, 106.8 and 105.4; zygomatic breadth, 60.3 and 60.7; mastoid breadth, 38.8 and 38.6; interorbital constriction, 18.0 and 19.0; postorbital constriction, 10.8 and 12.2; rostral breadth in front of canines, 13.2 and 12.8; mandible, 80.6 and 78.8; upper tooththrow (excl. inc.), 39.0 and 41.2; lower tooththrow (excl. inc.), 43.3 and 46.2.

The right upper canine of no. 20227 was removed in early life by an injury that left no trace of the tooth or alveolus. No appreciable distortion of the rostrum can be seen.

"Captured by natives in the lowland jungles near Kuta Tjane. They had a peculiar, penetrating odor that was not particularly unpleasant."

20. *Paguma larvata leucomystax* (Gray)

Paradoxurus leucomystax Gray, Proc. Zool. Soc. London, pt. 4, p. 88, 1836 (Type locality, Sumatra, probably in the vicinity of Benkulen).

Paguma larvata leucomystax Robinson and Kloss, Journ. Fed. Malay States Mus., vol. 8, pt. 2, p. 10, June 1918; Chasen, Handlist, p. 99, April 1940.

20229, ♂ ad. Kuta Tjane (600 ft.); $539 \times 487 \times 101 \times 41$. Wt., $6\frac{1}{2}$ lbs.

Measurements of skull (teeth beginning to wear; rostral and cranial sutures not completely closed: condylobasal length, 105.2; zygomatic breadth, 60.7; mastoid breadth, 38.9; interorbital constriction, 19.2; postorbital constriction, 12.0; rostral breadth in front of canines, 12.4; mandible, 78.8; maxillary tooththrow exclusive of incisors (crowns), 41.1; mandibular tooththrow exclusive of incisors (crowns), 46.7.

The skin differs from the dark specimens of *Paguma larvata leucomystax* in the United States National Museum (from Borneo and Tenasserim) in the reduction of the facial "mask" to mere traces consisting of a dull buffy spot in front of each ear about as large as the area covered by the ear when laid forward; most of the hairs lying between these spots and the eyes have inconspicuous subterminal buffy rings.

The Sumatran local form seems to be characterized by small size, and, as compared with *P. l. jourdani* of the southern part of the Malay Peninsula (according to Mr. Pocock, Proc. Zool. Soc. London, 1934, p. 678) by the "darker hue of the dorsal and ventral surfaces, the nape, shoulders, and crown being blacker, the hind back and flanks browner, the red speckling of the pelage, when present, deeper and more russet, and the ventral surface brown or reddish brown; facial pattern sometimes the same as in *jourdani*, sometimes darker; legs and tail nearly black."

"Captured by natives in the lowland jungles near Kuta Tjane. It had, like *Paradoxurus*, a peculiar, penetrating odor that was not particularly unpleasant."

21. *Arctictis niasensis* (Lyon)

Arctictis niasensis Lyon, Proc. U. S. National Museum, vol. 52, p. 443. December 30, 1916. ("Flat skin, imperfect, bought of a native who had killed it in the hills near Fadoro," Abbott).

Arctictis binturong niasensis Chasen, Handlist, p. 99, April 1940.

20407, ♀ imm. Soliga, Nias Island, July 20, 1939. Facial and cranial sutures open; milk incisors, milk canines and milk premolars partly in place.

Head and body, 507; tail, 494; hind foot, 106; ear from crown, 46; skull (measurements in parenthesis are those of a slightly more immature female, m¹ and m, the only permanent teeth in place, from Pulo Tebing Tinggi, off northeast coast of Sumatra, no. 144,322; U. S. N. M.): condylobasal length, 103.0 (106.8); zygomatic breadth, 58.2 (54.0); mastoid breadth, 43.2 (40.6); greatest height, skull resting on flat surface, 41 (35.6); ratio of greatest height to condylobasal length, 39.8 (42.4); interorbital constriction, 21.0 (13.6); postorbital constriction, 30.7 (33.2); rostral breadth in front of canines, 17.4 (13.5); mandible, 76.0 (76.8); upper canine and cheekteeth (crowns) 33.0 (32.8); lower canine and cheekteeth, 37.0 (37.0).

As compared with two immature skulls of *Arctictis binturong* from Pulo Tebing Tinggi, eastern Sumatra (male no. 144,322 and female no. 144,323 U. S. N. M.) and a slightly less immature specimen (permanent incisors and cheekteeth in place, permanent canines not yet up) from Siak River, Sumatra (male no. 144,118 U. S. N. M.) the skull from Nias differs conspicuously in the outline of its dorsal surface (when skull is viewed from the side, see Pl. 5, above). This surface rises gradually from the base of the nasal bones to the bregma, where it attains its greatest height (skull resting on a flat surface). In the young skulls from Pulo Tebing Tinggi and Siak River the increase in height is so much more rapid that the greatest height is found in the region lying slightly behind the level of the postorbital processes of the frontal. The surface of the frontal in these three skulls has a slightly porous appearance (not seen in the skull from Nias) suggesting that the swollen condition might be due to the action of parasites in the frontal sinuses; but, on opening the right sinus of skull no. 144,118 U. S. N. M., I can see no evidence of such infestation.

The skull from Nias differs further from the comparable immature Sumatran specimens in the less inflation of its auditory bullae. From a straight-edge laid across the bullae the greatest perpendicular distance to the surface of the basioccipital is only 7.0 mm. in the specimen from Nias. It is 8.2 in the male from Pulo Tebing Tinggi, 9.0 in the female from the same locality, also in the male from Siak River, and 8.0 in an immature female from Trong, Lower Siam (no. 84,423 U. S. N. M.).

Teeth, so far as they are comparable (upper carnassial and first molar, lower premolars and carnassial) smaller than the corresponding teeth of immature Sumatran specimens (distance from front of upper carnassial to back of first molar only 10 mm., as compared with 12.4 mm. in no. 144,118 U. S. N. M., from Siak River and also in no. 144,323 U. S. N. M., from Pulo Tebing Tinggi); crown of lower carnassial 7.0×5.8 as compared with 9.4×5.6 and 7.8×5.2 in the same skulls. The upper carnassial is peculiar in the shortness of its anterior border as compared with the outer and inner borders of its crown; lower carnassial broader in front than behind, this breadth and the almost squarely truncate anterior border giving the crown an outline that I have not seen in any other specimen. Lower permanent premolars smaller than the corresponding teeth of Abbott's skulls from Siak River and Pulo Tebing Tinggi but not peculiar in form. The three lower milk premolars (still in place on the right-hand side) do not differ noticeably from those of young female no. 144,322 U. S. N. M., taken on Pulo Tebing Tinggi. Permanent incisors upper 1 and 2 smaller than the corresponding teeth in the Sumatran specimens.

The skin of no. 20407 appears to be that of an animal considerably younger than the type specimen (an imperfect skin with no skull), as shown by the greater abundance of pale-ringed hairs on its back and sides. As is the case in the type specimen the pale rings are more strongly tinged with tawny (especially on the neck and flanks) than they are in any of the binturongs that Abbott collected on the Sumatran mainland.

"The young binturong was purchased alive from the natives of Soliga in Central Nias and was the only one I saw, although I heard of one other specimen in captivity near Gunong Sitoli. It was my desire to bring the binturong to Philadelphia alive in order to note any color changes with maturity, for apparently most of the bearcats have a rich suffusion of ochraceous when young. It is to be regretted that, because of its distant blood relationship to the mongoose, this rare animal was refused entry into the United States alive by the Biological Survey."

22. *Felis bengalensis sumatrana* (Horsfield)

Felis sumatrana Horsfield, Zool. Researches Java and neighboring islands, pl. and text, pages not numbered, 1824. Type locality, probably in the neighborhood of Bengkulu, Sumatra.

[*Felis bengalensis*] *sumatrana* Trouessart, Cat. Mamm. viv. foss., p. 358, 1898.

Felis bengalensis sumatrana Chasen, Handlist, p. 107, April 1940.

20225, ♀ juv., Gunong Shaitan, Atjeh (900 ft.). Kitten with full milk dentition (all cranial sutures open). Head and body, 353; tail, 141; hind foot, 89; ear from crown, 37; weight, 717 gr. (1 lb. 9.3 oz.); condylobasal length of skull, 65.5; zygomatic breadth, 47.0; rostral breadth across roots of canines, 17.0; interorbital constriction, 12.0; postorbital constriction, 28.0; greatest breadth of braincase, 38.0; depth of braincase at basal suture, 29.0; mandible, 44.0; depth of mandible thru coronoid process, 19.0; maxillary tooththrow (milk teeth), 18.2; mandibular tooththrow (milk teeth), 18.0.

"This immature specimen was brought in alive by the natives at Gunong Shaitan. The 'kuching-rimau' ('tiger cat') was apparently common around Medan, the natives often bringing live examples to the 'Deirenpark.' On an abandoned tobacco plantation near Medan one of our native collectors shot one of these cats at such close range that we were unable to save it as a specimen."

23. *Felis temminckii* Vigors and Horsfield

Felis temminckii Vigors and Horsfield, Zool. Jour., London, vol. 3, no. 11, p. 451, pl. 22, December 31, 1827 (Type locality, probably in the neighborhood of Benkulen, Sumatra).

Felis temminckii temminckii Chasen, Handlist, p. 106, April 1940.

20224, ♂ ad. Near Kungke, Atjeh, at altitude of 3,281 ft. Cranial sutures closed; sagittal crest well developed, 10 mm. high posteriorly; teeth beginning to wear. Head and body, 724; tail, 447; hind foot, 166; ear from crown, 41.5; weight, 20 lbs.; condylobasal length of skull, 123.5; zygomatic breadth, 92.0; rostral breadth across canine alveoli, 31.6; interorbital constriction, 25.0; postorbital constriction, 32.6; greatest breadth of braincase, 50.0; depth of braincase (exclusive of crest) 42.4; mandible, 57.5; depth of mandible in front of molar, 16.6; depth of mandible through coronoid process, 45.6; maxillary tooththrow (alveoli), 41.4; mandibular tooththrow (alveoli), 46.0.

"The golden cat was captured alive in the mountains near Kungke in a native box-trap baited with chicken."

24. *Ailurin planiceps* (Vigors and Horsfield)

Felis planiceps Vigors and Horsfield, Zool. Journ., London, vol. 3, no. 11, p. 450, pl. 2, December 31, 1827 (Type locality, probably in the neighborhood of Benkulen, Sumatra); Chasen, Handlist, p. 106, April 1940.

Ailurin planiceps Lyon, Proc. U. S. Nat. Mus., vol. 34, p. 659. September 14, 1908.

20226, ♀ ad. (cranial sutures closed; teeth beginning to wear) Mabar, lowlands of Deli. Head and body, 449; tail, 124; hind foot, 98; ear from crown, 36; weight, 2 lbs. 14.5 oz.; condylobasal length of skull, 88.0; zygomatic breadth, 56.0; rostral breadth across roots of canines, 21.0; interorbital constriction, 12.0; postorbital constriction, 19.6; greatest breadth of braincase, 38.6; depth of braincase at basal suture, 30.4; mandible, 63.0; depth of mandible through coronoid process, 25.0; maxillary tooththrow (crowns), 31.6; mandibular tooththrow (crowns), 33.2.

"The flat-headed cat was obtained from natives in the lowlands of Deli Province. It was in such bad condition that I was unable to save the skin."

25. *Nycticebus coucang hilleri* Stone and Rehn

Nycticebus coucang hilleri Stone and Rehn, Proc. Acad. Nat. Sci. Philadelphia, 1902, p. 139, issued June 4, 1902 (Type locality, Padang Highlands, Sumatra).

Nycticebus coucang hilleri Chasen, Handlist, p. 89, April 1940.

20222, ♂ ad. (basal suture closed, teeth beginning to wear) and 20223, ♂ ad. (teeth moderately worn), both captive animals bought at Kuta Tjane (600 ft.). Measurements: head and body, 263, 279; tail, 25, 27; hind foot, 58, 63; ear from crown, 14, 16; weight, 15.3 oz., 1 lb. 6.5 oz. Parietal ridges 10.5 mm. apart in no. 20222, joined to form a short sagittal crest about 2 mm. high in no. 20223. Measurements of skulls: condylobasal length, 56.0 and 58.5; zygomatic breadth, 41.0 and 45.0; rostral breadth across roots of canines, 12.2 and 12.5; interorbital constriction, 5.0 and 5.2; postorbital constriction, 18.6 and 17.0; mastoid breadth, 35.0 and 38.0; depth of braincase in region of basal suture, 23.0 and 24.6; mandible, 36.7 and 39.0; depth of mandible through coronoid process, 19.0 and 21.6; depth of mandible at middle of m_3 , 9.0 and 8.6; maxillary toothrow (crowns), 21.0 and 21.0; mandibular toothrow (crowns), 19.0 and 18.2 (canines injured).

In both specimens the ground color is somewhat paler than in three Sumatran skins in the United States National Museum, one each from Tapanuli Bay, Tarussan Bay and Pulo Tebbing Tinggi.

Both skulls and the entire skeleton of no. 20223 (that of no. 20222 not preserved) show obvious signs of long-continued captivity and consequent malnutrition. This is especially noticeable in the spongy texture of the vertebrae of 20223, and in the rough, unpolished upper surfaces of the two skulls.

In his Handlist of Malaysian Mammals (Bull. Raffles Mus., Singapore, no. 15, pp. 88-89, April 1940) Mr. Chasen records both *Nycticebus coucang* and *N. c. hilleri* as occurring in Sumatra, but without indicating the localities at which either form occurs. Among the few Sumatran specimens that I have been able to examine the differences appear to be no greater than might be expected to result from individual variation.

"Our two specimens, from the jungle around Kuta Tjane, were brought in by natives. During the daytime they slept in tightly-curved balls, but at dusk they became active. Their movements all seemed to be in 'slow motion', and to watch a moving object they would move the entire head after the manner of an owl, their eyes scarcely changing position. They were surly and would utter a curious rattling snarl when disturbed. The Malay name for the animal is 'coucang'."

26. *Macaca fascicularis* (Raffles)

Simia cynomolgus Schreber, Säugethiere, vol. 1, p. 91, 1774. Not *Simia cynomolgus* Linnaeus, 1758. (Part: included the hamadryas baboon and Buffon's "macaque").

Macacus cynomolgus Desmarest, Mammalogie, pt. 1, p. 65, 1820 (Not *Simia cynomolgus* Linnaeus, 1758, the hamadryas baboon, see Thomas, Proc. Zool. Soc. London, 1911, p. 128, March 1911); Lesson, Man. de Mammalogie, p. 42, 1827; Charles-Frédéric Cuvier in F. Cuvier, Hist. Nat. Mammif., vol. 7, tabl. gén. et méth., p. 1, 1841 ("cynomolgus"); Trouessart, Catal. Mamm., viv. foss., p. 24, 1898.

Simia fascicularis Raffles, Trans. Linn. Soc. London, vol. 13, p. 246, 1822 (Type locality, Sumatra, near Benkulen).

Macacus irus Blanford, Proc. Zool. Soc. London, 1887, p. 624 (Not the non-binomial "*Irus*" of F. Cuvier, 1818, Mém. Mus. Hist. Nat. Paris, vol. 4, p. 120, a baboon).

Macacus fascicularis Bonhote, Fasciculi Malayenses, Zool., vol. 1, p. 3, July 1903; Miller, Proc. U. S. Nat. Mus., vol. 31, p. 275, September 11, 1906.

Macacus irus Cabrera, Ann. and Mag. Nat. Hist., ser. 8, vol. 6, p. 620, December 1910 (Not the non-binomial "*Irus*" of F. Cuvier, 1818).

Macaca irus irus Chasen, Handlist, p. 66, April 1940.

20217, ♀ imm. Deli (sea level); $374 \times 514 \times 116 \times 23$. Wt. $8\frac{1}{2}$ lbs.

20218, ♀ (fetus of no. 20217); $111 \times 103 \times 31$.

20219, ♀ ad. Deli (sea level); $380 \times 510 \times 111 \times 18$. Wt. 6 lbs.

20220, ♀ (fetus of no. 20219); $54 \times 35 \times 10.5$.

20221, ♂ imm. Medan (near sea level); $349 \times 442 \times 121 \times 18$.

Cranial measurements of the adult female (incisors and canines much worn, third molars in place but not worn): greatest length, 98.6; condylo-basal length, 74.8; zygomatic breadth, 64.4; mastoid breadth, 54.4; breadth of rostrum over canines, 26.0; interorbital constriction, 3.4; postorbital constriction, 37.0; depth of braincase at basal suture, 40.6; mandible, 70.0; depth of mandible through coronoid process, 31.6; upper molars and premolars (crowns), 30.4; mandibular toothrow, entire (alveoli), 44.0.

"The crab-eating macaque is ubiquitous. We found the animal everywhere from the tidal flats of the Deli River up to 3,000 ft. in the cultivated valleys. In the mangrove swamps of the Deli River small bands were seen on mud flats, feeding close to the water's edge. When alarmed these monkeys ran away across the mud, not resorting to trees as the langurs did under like circumstances. The cheek pouches of those that I collected were filled with large beans and pieces of bean-pods. Near Medan they haunted the plantations and native gardens. Along the railroad between Medan and Siantar I noticed bands of them in the scrubby jungle that lay between the tracks and the big plantations. As the train passed the animals would jump up and down excitedly. The natives often keep these monkeys for pets, as they also keep the larger *M. nemestrinus*. At Blangnanga we had a tame young female whose chief occupation, when she was not catching flies, was turning over sods in search of beetle larvae."

The specific name of the "cra" or common Sumatran macaque has had a curious history. In 1818 Frédéric Cuvier published a paper entitled "Du Macaque de Buffon" (Mém. Mus. Hist. Nat., Paris, vol. 4, pp. 109-120) in which he was wrongly supposed by Blanford in 1887 (Proc. Zool. Soc. London, p. 623) and by Mr. Cabrera in 1910 (Ann. and Mag. Nat. Hist., London, ser. 8, vol. 6, p. 620, December 1910), to have applied the name "*Macacus irus*" to the animal that Buffon figured in 1762 (Histoire Naturelle, vol. 14,

pl. 20, 1762) under the name "Le Macaque." Though this opinion has been generally accepted I believe it to be incorrect, for the following reasons:

Buffon's plate is a good representation of a crab-eating macaque of some kind; but it is not accurate enough to permit the animal that it represents to be exactly placed among the local forms of "crabeaters" known today. Throughout his paper of approximately 2550 words F. Cuvier used no binomial terms except those that appear in quotations from the earlier writers (Linnaeus, Marcgrave, Osbeck, Ray) to whose work he had occasion to refer. After describing Buffon's figured animal and some living monkeys that he supposed to be of the same kind, he concluded (last paragraph of p. 120) that the name "Macaque" may properly be kept for the monkey to which Buffon had originally applied it. He then proposed to give to the hamadryas baboon that Linnaeus had called *Simia cynamolgos* in 1758 (Syst. Nat., ed. 10, p. 28) the new designation "*Irus*", which he thought was very appropriate for an animal that seemed to him quite as disgusting as Homer's odious beggar of the same name. The term *Irus* was used only once in this article, and then in a manner to make it clearly a parallel to the vernacular word "Macaque." I have been unable to find that its author ever used it again, or that anyone put it into binomial form until Blanford did so in 1887, when he incorrectly attributed to F. Cuvier a technical name "*Macacus irus*."

F. Cuvier set forth his ideas in a passage whose exact wording is important in view of the fact that it has been misunderstood by two such careful writers as Blanford and Mr. Cabrera, both of whom thought that the French naturalist had formally given the specific technical name *irus* to a macaque. Through their influence the binomial "*Macacus irus*" came into common use, but quite wrongly. The passage in question (p. 120 of F. Cuvier's paper) is as follows:

"Quant à celui [le nom] de Macaque, comme il paroît que c'est le nom générique que les Portugais donnent aux quadrumanes, et particulièrement aux singes, il peut rester sans inconvénient à l'espèce à laquelle Buffon l'a donné [a crab-eating Macaque]; nous le lui conserverons donc, et nous proposerons de substituer à celui de Cynomolgos [clearly shown by F. Cuvier himself, pp. 118-119, to have been used by Linnaeus for a baboon] celui d'*Irus*, assez convenable, à ce qu'il nous semble, pour un singe dégoûtant de saleté, d'impudeur et d'effronterie."

27. *Macaca phaeura* Miller

Macacus phaeura Miller, Smithsonian Misc. Coll., vol. 45, p. 63, November 6, 1903 (Type locality, Siaba Bay, Nias Island).

Macaca irus phaeura Chasen, Handlist, p. 69. April 1940.

20404, ♂ ad. (third molars beginning to wear); $436 \times 517 \times 141 \times 28$.

20405, ♂ imm. (third molars not fully in place); $365 \times 483 \times 125 \times 23$.

20406, ♀ ad. (third molars fully in place and showing first traces of wear); all from Hilisimaetano, Nias. $381 \times 431 \times 107 \times 21$.

These are typical examples of the dark-tailed Nias species.

Cranial measurements of the two adults (skull of female imperfect, no braincase): greatest length of skull, 122.6 (—); condylobasal length, 95.5 (—); mastoid breadth, $63 \pm$ (—); breadth of rostrum over canines, 35.8 (25.0); interorbital constriction, 5.5 (5.8); postorbital constriction, 43.4 (41.0); depth of braincase at basal suture, 48.0 (—); mandible, 88.0 (—); depth of mandible through coronoid process, 45.0 (—); maxillary tooth-row (alveoli), 38.6 (33.0); mandibular toothrow, entire (alveoli), 50.0 (40.2).

"The country around Hilisimaetano consisted of low, rolling hills on which were native gardens, large tracts of coarse, tall grass, and occasional patches of thick jungle in which a spiny, climbing palm (*Calamus*) was very common and clumps of bamboo were plentiful. It was only in the more remote growths of jungle that the Nias macaques were encountered; but in such places the animals were fairly numerous, traveling in bands of about a dozen individuals. They were always high in the trees where their typically macaque-like chucklings would be heard long before the animals themselves could be seen. In keeping so strictly to the trees they differed notably from their Sumatran relatives, *Macaca fascicularis*, which appeared to spend much time on the ground."

28. *Presbytis cristata* (Raffles)

Simia cristatus Raffles, Trans. Linn. Soc. London, vol. 13, p. 244, May 1821 (Type locality, "forests near Benkulen", Sumatra).

Presbytes [sic] *cristatus* Miller, Proc. U. S. Nat. Mus., vol. 26, p. 477, February 3, 1903.

Pithecus pyrrhus cristatus Chasen, Handlist, p. 83, April 1940.

20212, ♀ yg. ad. (skull with sagittal and metopic sutures open; permanent dentition fully in place; teeth slightly worn).

20213, ♀ (fetus of no. 20212); $105 \times 111 \times 29$.

20214, ♀ ad., lactating (skull with sagittal and metopic sutures completely closed).

Both specimens were taken in the swamps of the Deli River between Labuan and Belawan. They appear to be in every way similar to adults in the United States National Museum collected by Abbott on the Indragiri River in 1901 and by Kloss on the Siak River in 1906.

Measurements: head and body, 421, young adult (497, adult); tail, 705 (672); foot, 144 (153); ear from crown, 20 (21); weight, 15.5 lbs. (15 lbs.); greatest length of skull, 89.6 (89.8); condylobasal length, 70.8 (72.3); zygomatic breadth, 75.8 (79.7); mastoid breadth, 58.6 (58.1); breadth of rostrum over canines, 23.0 (22.9); interorbital constriction, 9.3 (8.5); postorbital constriction, 39.2 (40.5); depth of braincase at basal suture, 39.0 (40.5); mandible, 66.6 (65.8); depth of mandible thru coronoid process, 43.0 (40.4); depth of mandible between m_2 and m_3 , 16.8 (17.3); maxillary toothrow (alveoli), 28.4 (30.6); mandibular toothrow, entire (alveoli), 36.2 (37.2).

"In the mangrove swamps of the Deli River estuary this langur, or 'lutong', was heard more often than seen. The call notes consisted of series of deep guttural coughs by means of which one group of animals would signal to another. Several times I saw solitary old males sitting in startlingly human postures on limbs of trees overhanging the water, their long, non-prehensile tails hanging down limply. More often they were found in groups of from five to a dozen individuals occupying the tops of the taller trees that rose above the mangrove tangles. They were very suspicious of the native canoes, and, at the approach of such a boat they would promptly fling themselves plummet-like out of the tall trees into the mangrove thickets below, where they were soon lost to view.

"Because of the damage they do to plantations these monkeys are given no protection by the Dutch authorities. Although the Dutch commonly apply the name 'lutong' to these animals, the natives generally use the term 'monyet' indiscriminately for langurs, macaques and gibbons.

"The huge 3-chambered stomachs of the specimens that I collected were distended with finely-chewed evergreen leaves."

29. *Presbytis thomasi nubilus* new subspecies

20215, ♂ ad., Meluwak (1,640 ft.); $447 \times 658 \times 174 \times 22$. Wt., 12.5 lbs.

20216, ♀ ad., Blangnanga (3,600 ft.); $526 \times 656 \times 164 \times 17$. Wt., 15.5 lbs.

TYPE.—Adult, female, A. N. S. P. no. 20216, collected at Blangnanga base camp (3,600 ft.), Atjeh, north Sumatra, March 29, 1939, by Frederick A. Ulmer, Jr. Original number, 343. (Captured alive by Atchin natives on ground in alang-alang grass country; no embryos.)

Description.—Differs from *Presbytis thomasi thomasi* (as represented by 8 specimens in the United States National Museum, collected by Abbott at Aru Bay northeast Sumatra, near Langkat, the type locality, December 1905) in longer, fuller fur and darker, more slaty (less ochraceous) general color of upperparts and of outer surfaces of limbs. Hairs of back and of outer surfaces of arms and legs without the noticeable lighter bases that are seen in the lowland animals when the hairs are separated. Depth of fur at middle of shoulders about 60 mm. instead of about 40 mm. (scattered longer hairs, disregarded); longest hairs at middle of tail 40 mm. in type specimen, 25 mm. in no. 20215 (ranging from 15 mm. to 20 mm. in the 8 specimens of true *thomasi*); skull and teeth as in the lowland animal.

Measurements.—Type and paratype (the latter in parentheses): head and body, 526 (447); tail, 656 (658); foot, 164 (174); ear from crown, 17 (22); weight, 15.5 lbs. (12.5 lbs.); greatest length of skull, 93.8 (92.2); condylobasal length, 70.0 (68.1); mastoid breadth, 62.6 (61.6); breadth of rostrum over canines, 25.2 (25±); interorbital constriction, 9.9 (6.5); post-orbital constriction, 43.0 (46.0); depth of braincase at basal suture, 43.6 (43.0); mandible, 63 (63); depth of mandible thru coronoid process, 42.0 (37.0); depth of mandible between m_2 and m_3 , 28.1 (26.0); maxillary canine to m^3 inclusive (alveoli), 29.5 (29.0); mandibular canine to m_3 inclusive (alveoli), 34.0 (32.0).

"We found this handsome langur in the heart of Atjeh only. There we met with small bands of the animals in the heavy primeval jungle between Gunong Shaitan and Agusan. We also saw them near our base camp at Blangnanga (3,700 ft.) where they lived on the forested banks of the water courses that cut thru the wide, alang-grass covered foothills. Their call was a series of quick guttural coughs very much like that of the crested langur. Although the animals were mainly active during the day we often heard this loud call during the night. On the slopes of Mt. Löser we saw this leaf-eating monkey up to an altitude of about 7,000 feet."

30. *Hylobates albimanus vestitus* new subspecies

20205, ♂ ad., Meluwak (1,640 ft.); $400 \times 0 \times 130 \times 14.6$. Wt. 8.5 lbs.

20206, ♀ ad., Kungke (3,281 ft.); $408 \times 0 \times 140 \times 18$. With newborn young.

20207, ♂ (newborn young of no. 20206); $155 \times \text{---} \times 53$.

20208, ♀ ad., Blangnanga (3,600 ft.); $387 \times 0 \times 124 \times 19$. Wt. 11.5 lbs.

20209, ♀ ad., Blangnanga (3,600 ft.); $405 \times 0 \times 133 \times 15$. Wt. 11.5 lbs.

20210, ♀ ad., Meluwak (1,640 ft.); no measurements. Wt. 9 lbs.

20211, juv., Meluwak (1,640 ft.); no measurements.

TYPE.—Adult, female, A. N. S. P. no. 20208, collected at Blangnanga base camp (3,600 ft.), Atjeh, north Sumatra, April 3, 1939, by Frederick A. Ulmer, Jr. Original number, 362.

Description.—The five skins collected in Atjeh differ from six adults (5 males, 1 female) collected at Aru Bay, northeast Sumatra, by Abbott, in December 1905, as follows: fur fuller and more silky in texture, the length of the hairs at middle of back about 65 mm. instead of about 45-55 mm.; general ground color of upper parts slightly paler; face markings more strongly contrasted, the pale facial ring nearly white instead of light buff, this very conspicuously set off by contrast with the dark brown area that lies immediately behind it; dark cloudings at knees and wrists more strongly contrasted with the pale surrounding areas than in the lowland race.

Measurements.—Type and topotype (the former, no. 20208, female with much worn teeth): head and body, 405 (387); foot, 133 (124); ear from crown, 15 (19); weight, 11.5 lbs. (11.5 lbs.); greatest length of skull, 99.0 (104.3); condylobasal length, 83.8 (82.2); mastoid breadth, 65.8 (68.6); breadth of rostrum over canines, 28.8 (28.0); interorbital constriction, 11.6 (11.1); postorbital constriction, 46.0 (46.4); depth of braincase at basal suture, 50.0 (51±, injured); mandible, 69.5 (68.5); maxillary canine to m² inclusive, 29.4 (30.4); mandibular canine to m₃ inclusive, 33.2 (33.2).

"White-handed gibbons were very numerous in the hilly jungles of Atjeh. While we were in the region between Gunong Shaitan (900 ft.) and Blangkedjeren (2,900 ft.) the animals were rarely out of sight or hearing. Small family groups were often seen clinging to the slenderest branches of tall trees along the trail. At Blangnanga (3,700 ft.) the gibbons were much in evidence, coming down to the edge of the hill-jungle where it meets the

alang-alang grass fields of the lower valley. Here, as soon as the morning sun had warmed the valley (about 8 A. M.) the gibbons would begin whooping, and, if there were no rain, they would continue to call until well after noon. First one family group would begin to repeat the call (to which the animals owe their native name 'wau-wau'); other groups would soon answer until the air was filled with their cries. I observed these animals up to an altitude of about 5,000 feet, and never saw more than five in a group."

31. *Symphalangus syndactylus* (Raffles)

Simia syndactyla Raffles, Trans. Zool. Soc. London, vol. 13, p. 241, 1822.

Symphalangus syndactylus Schneider, Zool. Jahrb., syst., vol. 23, p. 50, 1905.

Hylobates syndactylus syndactylus Chasen, Handlist, p. 63, April 1940.

20201, ♂ young (basal and sagittal sutures open, the latter with 5 Wormian bones; upper canines and all four posterior molars not in place). Gumpang River, below Meluwak, Atjeh. (About 1,600 ft.) $514 \times 0 \times 153 \times 18$. Wt. 21 lbs.

20202, ♀ ad. (basal and sagittal sutures closed). Kungke, Atjeh. (About 3,200 ft.) $497 \times 0 \times 158 \times 17$. Wt. 27.5 lbs. Lactating.

20203, ♂ ad. (basal and sagittal sutures closed; teeth moderately worn). Gunong Shaitan, Atjeh. (About 900 ft.)

20204, ♀ young ad. (basal suture open, but all permanent teeth in place and beginning to wear). Gunong Shaitan, Atjeh. (About 900 ft.)

Cranial measurements of adult female no. 20202 and adult male no. 20203: greatest length, 120.0 (126.5); condylobasal length, 102.4 (105.2); zygomatic breadth, 81.4 (84.7); mastoid breadth, 71.6 (75.5); breadth of rostrum over canines, 36.3 (38.2); interorbital constriction, 11.6 (13.9); postorbital constriction, 47.1 (49.6); depth of braincase at basal suture, 52.6 (52.0); mandible, 88.0 (91.4); maxillary tooththrow (crowns), 40.6 (38.0); mandibular tooththrow (crowns), 47.5 (45.0); crowns of three upper molars, 21.0 (20.6); crown of second upper molar, 8.0×8.0 (7.6×7.2); crowns of three lower molars, 26.4 (24.0); crown of second lower molar, 8.6×7.4 (9.0×8.0).

The contrast between the large molars in the small skull of the female and the small molars in the large skull of the male is very noticeable. A female collected by Abbott at Tapanuli Bay, March 28, 1902 (no. 114,497 U. S. N. M.) has teeth of the same large size: crowns of its three upper molars, 24.0; crowns of its three lower molars, 26.4; while in one from Tarussan Bay (no. 141,161 U. S. N. M.), the teeth are not so large as those of the male from Gunong Shaitan: crowns of the three upper molars, 22.0; crowns of the three lower molars, 24.0. The variation therefore appears to be purely individual in character.

Unlike the white-handed gibbon the siamang of the Atjehan mountains has not become appreciably modified as compared with the lowland form. The specimens collected by Mr. Ulmer lack the peculiarities attributed by Pohl (Zool. Anzeiger, vol. 38, no. 2, pp. 51-53, July 11, 1911) to the race

that he described, under the name *Siamanga syndactylus volzi*, from Sumatran material collected at altitudes ranging from about 4,200 to about 4,600 feet.

"Siamangs were plentiful along the valley of the Agusan River, though not so numerous as the white-handed gibbons or 'wau-waus.' They were also seen at our Blangnanga base camp (3,600 ft.). In climbing the mountains I saw none at altitudes above 5,000 feet. Ordinarily the siamangs are slower and more deliberate than the wau-waus in their movements among the trees; but when frightened they can flee at a rapid pace. They were usually seen in small family groups of from three to six animals. The male that I shot at Meluwak (1,600 ft.) among the trees along the Gumpang River was accompanied by a female and a young one. His stomach contained wild figs, and both it and the small intestines were crowded with roundworms. The female taken at Kungke was lactating although her young one was not seen. Every morning the different troops of siamangs began to call at about 8 o'clock and often continued until long past noon. Their deep booming notes, which came in fits and starts, could be heard for a mile or more. On the west coast I observed siamangs in the hills back of Tapanuli Bay, probably where W. L. Abbott saw and collected them in 1902."

32. *Pongo abelii* Lesson

An Orang Outang (no technical name) Abel, Some account of an Orang Outang . . . Asiatic Researches, Serampore, vol. 15, p. 489, 1825. Ramboon, near Touraman on the northwest coast of Sumatra.

Pongo abelii Lesson, Man. de Mammalogie, p. 32, 1827.

S[im]ia abelii Fischer, Synops. Mammalium, p. 10, 1829.

Pongo abelii Lyon, Proc. U. S. Nat. Museum, vol. 34, p. 56, September 14, 1908.

Simia satyrus abelii Chasen, Handlist, p. 62, April 1940.

20200, ♀ ad., lowlands of eastern Atjeh; skin and skull, basal suture closed, teeth beginning to wear (a carious cavity [3.6 mm. diam. right, 4.6 mm. diam. left] between each pair of upper premolars). Measurements: height, 1.06 m.; skull, greatest length, 206.0 mm.; condylobasal length, 162.5; mastoid breadth, 116.5; breadth of rostrum over canines, 57.5; interorbital constriction, 12.5; postorbital constriction, 65.3; depth of braincase at basal suture, 78.0; mandible, 156; depth of mandible thru coronoid process, 80.5; depth of mandible between second and third molars, 35.0; maxillary canine to m⁸ inclusive (alveoli), 57.6; mandibular canine to m₃ inclusive (alveoli), 72.5.

"Orang-utans were fairly common in Atjeh, especially in the valley of the Agusan River. Between Kuta Tjane (500 ft.) and Blangkedjeren (2,900 ft.) we frequently saw them; and several of their bulky nests were built in trees that overhung the trail. At an altitude of 3,600 feet near our base camp, Blangnanga, several were observed; but higher than this the animals were not seen. Usually they hurried away as soon as they became aware of men in their vicinity; but on one occasion a large male feeding in

a fig tree between Kuta Tjane and Gunong Shaitan was so little disturbed by our observers that they succeeded in filming him. These animals are rigidly protected by the Dutch authorities and are therefore in little danger of becoming extinct. We heard of one killing (by a soldier); but, as no native is allowed to carry firearms, the possibility of harm from shooting is slight.

"The natives of Atjeh called the orang-utan 'mawas.' Our specimen, from the lowlands of Eastern Atjeh, was exhibited in the Dierenpark at Medan, where she was killed by her mate.

"Some 4 kilometers south of Kuta Tjane the natives had imprisoned an orang in their village. When Mr. George Vanderbilt visited the village, he threatened to report the natives to the Dutch Government and when we returned the next day both orang and cage had disappeared completely. The natives evidently realized that the orang was protected, and, fearing punishment, they destroyed both animal and cage."

On the subject of the Sumatran orang's present status Carpenter's survey of wild life conditions in Atjeh, North Sumatra (Netherlands Committee for International Wild Life Protection, Amsterdam, 1938) should be consulted.

33. *Callosciurus altitudinis* (Robinson and Kloss)

Sciurus tenuis altitudinis Robinson and Kloss, Journ. Straits Branch Roy. Asiat. Soc., Singapore, no. 73, p. 269, July 1916 (Type locality, Sungei Kring, Korinchi Peak, Padang Highlands, Sumatra); Chasen, Handlist, p. 142, April 1940.

Callosciurus tenuis altitudinis Hayman and Holt in Ellerman, Gen. Liv. Rodents, vol. 1, p. 356, June 8, 1940.

Specimens.—17 from the following localities: Meluwak (2,100 ft.), 7; Kungke (3,000 ft.), 1; Agusan (4,900 ft.), 1; Blangnanga (3,600 ft.), 4; Bivouac 3 (8,300 ft.), 3; Bivouac 5 (7,900 ft.), 1.

External measurements of 7 adults with closed basiscranial suture:

20247, ♂ ad., Meluwak; $141 \times 119 \times 38.5 \times 8$. Wt. 3.7 oz.

20251, ♂ ad., Blangnanga; $148 \times 112 \times 36 \times 11$. Wt. 3.2 oz.

20253, ♂ ad., Blangnanga; $143 \times 106 \times 37 \times 9$. Wt. 3.3 oz.

20243, ♀ ad., Meluwak; $146 \times 121 \times 37 \times 9$. Wt. 3.6 oz.

20252, ♀ ad., Blangnanga; $145 \times 125 \times 37 \times 10$. Wt. 3.4 oz.

20256, ♀ ad., Bivouac 3; $132 \times 112 \times 36.5 \times 12$. Wt. 3.0 oz.

20257, ♀ ad., Bivouac 5; $135 \times \text{—} \times 35.0 \times 11$. Wt. 3.1 oz.

Mammæ 3-3 = 6, as in *Callosciurus tenuis*.

Cranial measurements of largest and smallest adult skulls (♀, no. 20252 and ♂ no. 20253) greatest length, 40.8 and 39.5; condylobasal length, 37.0 and 36.0; zygomatic breadth, 23.8 and 23.4; diastema, 9.8 and 10.5; nasal, 12.8 and 12.2; least interorbital breadth, 13.0 and 13.0; postorbital constriction, 14.0 and 14.0; greatest depth of skull when resting on flat surface, 17.0 and 17.0; depth of rostrum at middle of incisive foramina, 8.0 and 8.0; mandible, 25.0 and 24.2; maxillary tooththrow (crowns), 7.0 and 7.2; mandibular tooththrow (crowns), 7.2 and 7.0. Ratio of nasal length to

interorbital breadth varying, in the whole series, from about 94 to about 100 as compared with a range from about 78 to 83 in *C. tenuis*.

Though the small Atjehan montane squirrel was described (on the basis of specimens from the highlands of Padang) as a subspecies of *Callosciurus tenuis* I do not hesitate to regard it as a distinct species. The elongated rostrum and small auditory bullae (antero-posterior diameter of bulla less than half as great as distance from basion to palation instead of obviously more than half as great) are perfectly distinctive features of this mountain animal as compared with the short rostrum and large bullae of *C. tenuis* from the lowlands (e. g., specimens in the United States National Museum from Tapanuli Bay, Sumatra, and from Singapore Island, the type locality). In cranial peculiarities (Pl. 3, figs. 1, 2) there are no suggestions of any tendency toward intergradation between the two animals. In color the highland squirrel is usually distinguishable from *Callosciurus tenuis* by its more yellowish hands and feet and by the light gray hue of its under parts (in most specimens a little buff-tinged on throat and under side of neck); but four skins nos. 20251, 20252, 20253, 20257) have the buff suffusion as conspicuous on the under parts and inner sides of the arms and legs as it ordinarily is in adult *C. tenuis* (23 specimens in the United States National Museum from lowland Sumatra). Mammary, 3—3=6, as in *C. tenuis*.

Adult male no. 20247, from Meluwak, has the tips of both nasal bones injured, evidently as the result of a heavy blow. The fracture of the right nasal is still evident, though perfectly healed. All of the upper teeth in this skull are normal; but the middle molar of both lower tooththrows is dark and shrunken, particularly the tooth on the side corresponding with the broken nasal bone. This unusual condition suggests the possibility that the fall or other accident that injured the nasal bones may have disturbed the nerve supply to the lower jaw during the period of dental growth, thus accounting for the anomalous condition of the two teeth.

Without comparison of specimens it is impossible to be certain that this squirrel is exactly the same as the animal described by Robinson and Kloss. As the highlands of Padang and Atjeh are separated by country that appears to be low enough to break the range of the highland squirrels, for instance in the region of Lake Toba, it seems probable that there has been no contact between the two mountain populations during a long period of time. On the other hand, the altitudinal range indicated by these specimens is so great (from 1,600 feet at Meluwak up to 8,300 feet at Bivouac 5) that the animal might well be able to extend its range from one of the extreme highland areas to the other.

"Only in heavy jungle did we find the little jungle squirrels, although there they were very abundant. When running up the trunks of tall trees

they were hard to distinguish from tree-shrews although they had the typical squirrel motions whereas the tree-shrews had a peculiar loping gait. They occupied no particular level in the vegetation but were to be seen in any forest at any level from low in the bushes to high in the very tops of tall trees. Though they are very quiet animals I often detected them by the loud noise they made in gnawing the curious acorn-like nuts that the natives call 'giseng.' The squirrels gnaw away the crowns of these nuts in a clock-wise, circular manner, and their sharp incisors leave a serrate edge that gives the margin of the hole the outline of a circular saw-blade. At Blangbeke (7,000 ft.) a young squirrel, well haired but hardly half-grown, was caught by our coolies [not in collection]. We saw these squirrels up to 8,300 feet. Probably they ranged even higher."

34. *Callosciurus humilis* (Miller)

Sciurus humilis Miller, Smithsonian Misc. Coll., vol. 61, no. 21, p. 24, December 29, 1913 (Type locality, Kateman River, east central Sumatra).

Sciurus lowii humilis Chasen, Handlist, p. 144, April 1940.

Callosciurus lowii humilis Hayman and Holt in Ellerman, Gen. Liv. Rodents, vol. 1, p. 357, June 8, 1940.

20260, ♀ ad. (teeth slightly worn; basal suture not closed), Kungke, Atjeh, 3,000 ft. $121 \times 86 \times 31$ (30) $\times 7.5$. Wt. 2 oz. Greatest length of skull, 33.6; condylobasal length, 30.0; zygomatic breadth, 20.2; least inter-orbital breadth, 10.6; postorbital constriction, 12.6; greatest depth of skull when resting on a flat surface, 16.0; depth of rostrum at middle of incisive foramina, 6.8; mandible, 20.0; maxillary tooththrow (crowns), 6.0; mandibular tooththrow (crowns), 5.4.

This squirrel agrees with the type specimen of *Callosciurus humilis* from the Kateman River, Sumatra, and with skins of *C. lowii* from Saratok River, southeastern Borneo, in having the whitish area of its under parts normal in width and sharply defined instead of "reduced in extent and indistinctly margined" as in *C. vanakeni* from Korinchi, Sumatra (*Sciurus vanakeni* Robinson and Kloss, Journ. Straits Br. Roy. Asiat. Soc., no. 73, p. 270, July 1916, from Barong Bharu, west side of the Barisan Range, at an altitude of about 4,000 ft.) and in *C. fraterculus* (*Sciurus fraterculus* Thomas, Ann. Mus. Civ. Stor. Nat. Genova, ser. 2, vol. 14, p. 669, January 7, 1895) from Sipora Island.

35. *Callosciurus piceus* (Peters)

Sciurus piceus Peters, Proc. Zool. Soc. London, p. 424, 1866. (Type locality, "Tenas-serim" = Sumatra. See Miller in Lyon, Proc. U. S. Nat. Mus., vol. 34, p. 638, September 14, 1908.)

Sciurus erebus Miller, Proc. U. S. Nat. Mus., vol. 26, p. 456, February 3, 1903. (Tapaneli Bay, Sumatra.)

Sciurus piceus Schneider, Zool. Jahrb., Syst., vol. 23, p. 109, 1905.

Sciurus prevostii piceus Chasen, Handlist, p. 128, April 1940.

Callosciurus prevosti piceus Hayman and Holt in Ellerman, Gen. Liv. Rodents, vol. 1, p. 367, June 8, 1940.

20279, ♂ ad. (teeth moderately worn), Kuta Tjane, Atjeh (600 ft.). Head and body, 223; tail, 216; hind foot, 57; ear from crown, 12.5; weight, 12.1 oz.

20280, ♂ yg. ad. (permanent premolars not in place), Deli, Medan, (sea level). Head and body, 227; tail, 223; hind foot, 60; ear from crown, 11; weight, 12.2 oz.

20281, ♀ ad. (teeth moderately worn), Deli, Medan. Head and body, 238; tail, 223; hind foot, 58; ear from crown, 14; weight, 14.5 oz.; mammae, ventral 1-1, inguinal 1-1 = 4.

These specimens exactly resemble those collected by Abbott at Tapanuli Bay in 1902, and at Aru Bay in 1905-6. (Lyon, Proc. U. S. Nat. Mus., vol. 34, p. 638, September 14, 1908.)

"It is interesting to record the recent establishment of this colorful squirrel in the region of Medan where the animal does not naturally occur. Our specimens from this locality are the descendants of a pair that escaped from Carl Berthold's zoo a few years ago. As Mr. Berthold made no attempt to recapture these animals the race soon became established around Medan. The American Consul at Medan, Mr. John B. Ketcham, told me that he had seen them on his grounds about three miles from the zoo. The original pair were brought from Kwala Simpang, on the coast northwest of Medan."

36. *Callosciurus nigrovittatus bocki* (Robinson and Wroughton)

Sciurus nigrovittatus bocki Robinson and Wroughton, Journ. Fed. Malay States Mus., vol. 4, no. 2, p. 167, April 1911 (Type locality, "Pajo" [= Pajokombo?], Padang Highlands, Sumatra); Chasen, Handlist, p. 139, April 1940.

Callosciurus nigrovittatus bocki Hayman and Holt in Ellerman, Fam. and Gen. Liv. Rodents, vol. 1, p. 368, June 8, 1940.

20263, ♂ ad., near Meluwak, at about 1,500 feet altitude. Head and body, 160; tail, 160; hind foot, 44; hind foot without claws, 41; ear from crown, 10. Skull, greatest length, 45.0; diastema, 10.0; zygomatic breadth, 27.6; interorbital breadth, 17.2; postorbital breadth, 18.7; breadth of braincase, 22.0; depth of braincase, 16.0; mandible, 28.0; maxillary tooththrow (crowns), 8.4; mandibular tooththrow (crowns), 8.4.

The peculiarities of this specimen agree in most respects with those of the animal described by Robinson and Wroughton from "Pajo" (= Pajokombo, Padang Highlands? See Chasen, Bull. Raffles Mus., Singapore, no. 15, p. 145, April 1940). The pale patches behind the ears and the pale side stripes are better developed than in most Javan specimens of *C. nigrovittatus nigrovittatus*, though no more than in no. 155,677 U. S. N. M., an adult male from Tjibodas, Mount Gedé (4,500 ft.), collected by William Palmer in August 1909. The skull is slightly smaller than in the Javan animal (greatest length 45 mm. instead of 46-48 mm.), the auditory bullae are less inflated, and the incisive foramina are shorter. In color the general tone of the back, sides, and cheeks is less buffy.

"This squirrel was not nearly so common as *C. vittatus nicotianae*. Both animals are called 'tupai' by the natives."

37. *Callosciurus nigrovittatus acraeus* new subspecies

20261, ♂ ad., Blangnanga (3,600 ft.); $168 \times 157 \times 41.4$ (38.4) $\times$ 7. Wt. 6 oz.

20262, ♂ ad., Blangnanga (3,600 ft.); $166 \times 149 \times 43$ (39) $\times$ 9. Wt. 6 oz.

TYPE.—Adult male, A. N. S. P. no. 20262, collected at Blangnanga Base Camp (alt. 3,600 ft.), Atjeh, north Sumatra, April 3, 1939, by Frederick A. Ulmer, Jr. Original number, 367.

Description.—Differs from *Callosciurus nigrovittatus bocki* (Robinson and Wroughton), as represented by the specimen collected near Meluwak, at an altitude of about 1,500 feet, in shorter, denser fur (depth of fur at middle of back about 10 mm. instead of about 15 mm.), shorter ears (height from crown about 8 mm. instead of about 10 mm.), and nearly complete absence of the postauricular pale area.

Measurements.—Type and paratype (the latter in parentheses): head and body, 168 (168); tail, 149 (157); hind foot, 43 (43); hind foot without claws, 38.4 (39); weight, 6 oz. (6 oz.). Skull, greatest length, 45.2 (44.6); condylobasal length, 41.0 (40.6); diastema, 10.0 (10.6); interorbital breadth, 18.2 (18.2); postorbital constriction, 17.0 (16.8); breadth of braincase, 21.6 (20.4±); depth of braincase, 15.0 (—); mandible, 17.6 (18.0); maxillary tooththrow (crowns), 8.0 (8.0); mandibular tooththrow (crowns), 7.8 (8.0).

Mr. Ulmer's remarks on *Callosciurus nigrovittatus bocki* apply to this mountain form of the species as well.

38. *Callosciurus vittatus nicotianae* (Sody)

Callosciurus notatus nicotianae Sody, Natuurk. Tijdschr. Ned.-Ind., Batavia, vol. 96, p. 217, 1936 (Type locality, Silalas, near Medan, Deli, Sumatra); Hayman and Holt in Ellerman, Fam. and Gen. Liv. Rodents, vol. 1, p. 369. June 8, 1940.

Sciurus notatus nicotianae Chasen, Handlist, p. 135, April 1940.

20273, ♀ ad., near Medan, Deli. $213 \times 202 \times 51 \times 10$. Wt. 11 oz.

20274, ♂ ad., " " " $195 \times 183 \times 49 \times 12$. Wt. 8.6 oz.

20275, ♂ ad., " " " $196 \times 188 \times 49 \times 11$. Wt. 8.4 oz.

20276, ♀ ad., " " " $197 \times 179 \times 48 \times 12$. Wt. 8.1 oz.

20277, ♂ ad., " " " $201 \times 177 \times 46 \times 11.5$. Wt. 9.3 oz.

It seems necessary to recognize the Medanese plantain squirrel as a distinct form in spite of the geographical nearness of Medan to Aru Bay, where Abbott collected typical specimens of *C. vittatus albescens* Bonhote (see Lyon, Smithsonian Misc. Coll., vol. 48, pt. 3, p. 281, February 4, 1907). The gray arms, legs, hands and feet, together with the buffy gray (instead of brownish buff) cheeks, and the apparently constant presence of speckled hairs on the under parts of its body, make the animal easy to recognize among the squirrels known to occur in Sumatra. The "speckled hairs" (not mentioned by Sody) on the under parts are particularly noticeable in nos. 20273, 20274 and 20277; less so, but evident on throat and along median line of chest and belly in no. 20275; inconspicuous in no. 20276).

These hairs are uniformly pale gray at base and buff at tip, each with an intermediate band (sometimes two bands) of black. The whitish hairs that are so conspicuous on the under parts and in the dark lateral stripes of *C. v. albescens* as to have suggested the technical name of the race are practically absent (a few may be seen in the dark lateral stripes of nos. 20274, 20276 and 20277, and on the chest of 20277). So far as can be determined from the rather unsatisfactory material at hand the skull is slightly larger than that of *C. vittatus albescens* (greatest length 48.0–50.8 mm. in 5 adult skulls as compared with a range of 47 to 48.3 in two from Aru Bay and 45.8–48.0 in 4 from Loh Sidoh Bay). It is not peculiar in form.

Although the expedition passed through "the submontane country north of Kuta Tjane" it did not collect any specimens of the "*Sciurus notatus percommodus*" recently described by Mr. Chasen from that region (type locality Lesten, Atjeh, 700 m.; Treubia, Buitenzorg, vol. 17, pt. 5, p. 489, December 1940), a squirrel that appears to be the same as the true *S. vittatus albescens* of Bonhote (see discussion of *Callosciurus albiculus*).

39. *Callosciurus vittatus tapanulius* (Lyon)

Sciurus vittatus tapanulius Lyon, Smithsonian Misc. Coll., vol. 48, p. 280. February 4, 1907 (Tapanuli Bay).

Sciurus notatus tapanulius Chasen, Handlist, p. 135, April 1940.

Callosciurus vittatus tapanulius Hayman and Holt in Ellerman, Fam. and Gen. Liv. Rodents, vol. 1, p. 370. June 8, 1940.

20278, ♀ ad. (lactating), 12 kilometers north of Sibolga, Tapanuli. 185 × 133 × 50 × 11. Wt. 9.1 oz.

A typical example of this richly colored west-coast race.

"Coconut squirrels were everywhere in abundance, inhabiting rainforest, secondary jungle, and even the coconut groves in the native kampongs. They do considerable damage to young, green coconuts, and are much disliked for this reason. When pursued they are very adept at keeping the trunk of a coconut palm between themselves and the hunter. Once safely in the feathery top of a palm they are perfectly concealed. However, a sharp rap on the palm trunk will usually bring them out again."

40. *Callosciurus albiculus* new species

Sciurus albescens albescens Chasen, Treubia, Buitenzorg, vol. 17, pt. 5, p. 490, December 1940. (Not *Sciurus notatus albescens* Bonhote, Ann. and Mag. Nat. Hist., ser. 7, vol. 7, p. 446, May 1901, Acheen Head; not *S. albescens albescens* Chasen, Handlist, p. 140, April 1940.)

20264, ♂ imm.,	Kungke, Atjeh, 3,000 ft.	161 × 117 × 41 × 11.	Wt. 5.1 oz.
20265, ♀ imm.,	" " "	169 × 135 × 41 × 10.	Wt. 5 oz.
20266, ♂ ad.,	Blangnanga, Atjeh, 3,600 ft.	156 × 140 × 40 × 9.	Wt. 5.3 oz.
20267, ♂ ad.,	" " "	166 × 157 × 42 × 8.6.	Wt. 5.8 oz.
20268, ♂ ad.,	" " "	159 × 152 × 43 × 10.	Wt. 4.7 oz.
20269, ♂ ad.,	" " "	172 × 125 × 44 × 10.	Wt. 5.6 oz.
20270, ♂ imm.,	" " "	169 × 167 × 44 × 11.	Wt. 5 oz.

20271, ♀ ad., Blangnanga, Atjeh, 3,600 ft. 170×166×45×12. Wt. 6.4 oz.

20272, ♀ ad., Blangkedjeren, 2,900 ft. 158×155×43×12. Wt. 5.1 oz.

TYPE.—Adult male (basal suture closed, teeth moderately worn), A. N. S. P. no. 20268, collected at Blangnanga Base Camp (alt. 3,600 ft.), Atjeh, north Sumatra, April 3, 1939, by Frederick A. Ulmer, Jr. Original number, 366.

Description.—A miniature of *Callosciurus vittatus albescens* (Bonhote); hind foot in 4 adults 40–45 instead of 45–48; greatest length of 4 adult skulls 42.3–45 instead of 44.0–48.6 in 3 comparable specimens of the larger animal; zygomatic breadth 25.6–26.8 instead of 26.0–28.1; interorbital breadth 14.9–16.5 instead of 15.7–18; height when resting on flat surface, 20–20.5 instead of 21.5–22.5; color essentially as in *C. v. albescens* except that the back and sides are a little more finely grizzled, and the upper surfaces of hind feet are slightly more tinged with buff. The color of the under parts shows the same wide range of variation that is seen in the larger animal.

Measurements.—Type: head and body, 159; tail, 152; hind foot, 43; hind foot without claws, 40; ear from crown, 10; skull, greatest length, 45.0 (48.6³); condylobasal length, 41.0 (44.4); zygomatic breadth, 26.7 (28.0); least interorbital breadth, 16.4 (17.6); postorbital constriction, 16.0 (17.4); greatest depth of skull when resting on a flat surface, 20.0 (22.0); depth of rostrum at middle of incisive foramina, 8.7 (10.0); mandible, 28.0 (30.4); maxillary tooththrow (crowns), 8.6 (9.0); mandibular tooththrow (alveoli), 8.0 (8.6).

Remarks.—Mr. Chasen, in his paper on "The mammals of the Mount Leuser expedition, 1937" (Treubia, Buitenzorg, vol. 17, pt. 5, p. 490, December 1940), has discussed the characteristics of this squirrel and the animal's relationship to the diminutive Bornean *Callosciurus adamsi* (*Sciurus adamsi* Kloss, Journ. Straits Branch Roy. Asiat. Soc., Singapore, no. 83, p. 151, April 1921, type locality, Long Mujan, about 150 miles up the Baram River, North Sarawak, Borneo, alt. 700–900 feet). His identification of the small Sumatran mountain animal with the *Sciurus notatus albescens* of Bonhote, 1901 (Ann. and Mag. Nat. Hist., ser. 7, vol. 7, p. 446, April 1901), seems to me, however, to be wrong. Having examined the type specimen, I am convinced that Bonhote's squirrel is the same as the one to which Mr. Chasen has now given the name *Sciurus notatus percommodus* (Treubia, Buitenzorg, vol. 17, pt. 5, p. 489, December 1940, Type locality, Lesten, Atjeh, altitude 2,100 ft.). This animal was not met with by Mr. Ulmer.

Bonhote's name *Sciurus notatus albescens* was based on a skin collected February 1, 1873, at Acheen Head, Sumatra, by Davison, and presented to the British Museum by Hume. That Davison visited no other part of

³ Cranial measurements in parentheses are those of an adult male *S. vittatus albescens* (no. 114,157 U. S. N. M.) from Loh Sidoh Bay, 13 miles south of Acheen Head, the type locality.

Sumatra at this time is clearly shown by the map of his route published by Hume in *Stray Feathers*, Calcutta, vol. 2, 1874, facing p. 28. On December 12, 1907, I compared this skin with one (no. 114,158 U. S. N. M.) taken by Abbott at Loh Sidoh Bay, only 13 miles south of Acheen Head (see map published by Dr. Lyon, *Smithsonian Misc. Coll.*, vol. 48, p. 283, February 4, 1907; the distance from Acheen Head to Loh Sidoh Bay is given by Abbott in his field catalog). I could find no differences between the two skins except that the one from Loh Sidoh Bay was "somewhat more buff below and darker above than the type" (note written at the time on the label of no. 114,158). There appeared to be nothing to suggest any divergences between the type and the Abbott specimen other than those that lay within the range of ordinary individual variation. The possibility that Davidson might have collected the small highland animal at Acheen Head is made to appear particularly remote by the fact that Abbott did not meet with this squirrel at the nearby Loh Sidoh Bay or at any of the six more distant coastal Sumatran localities at which he worked (see Dr. Lyon's map, *Smithsonian Misc. Coll.*, vol. 48, pt. 3, p. 283, February 4, 1907).

41. *Lariscus niobe* (Thomas)

Funambulus niobe Thomas, Ann. and Mag. Nat. Hist., ser. 7, vol. 2, p. 249, September 1898 (Type locality, "Pajo", Sumatra = Pajokombo?, Padang Highlands. See Chasen, Handlist, p. 145, April 1940).

Lariscus niobe Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, p. 35, June 1918.

Lariscus insignis niobe Chasen, Handlist, p. 145. April 1940; Hayman and Holt in Ellerman, Gen. Liv. Rodents, vol. 1, p. 392. June 8, 1940.

Funambulus insignis niobe Chasen, Treubia, Buitenzorg, vol. 17, pt. 5, p. 492. December 1940.

20285, ♂ juv. (milk premolars in place, third molars not up), near Meluwak, Atjeh (1,600 ft.). Head and body, 143; tail, 105; hind foot (dry), 41.5; hind foot (dry) without claws, 39.5; ear (from crown), 14. Skull, greatest length, 44.4; condylobasal length, 38.2; zygomatic breadth, 24.6; mandible, 26.0; weight, 3.5 oz.

Mr. Chasen writes, in his Handlist of Malayan Mammals, p. 145: "In Sumatra *insignis* and *niobe* have been said to live side by side, but although they may sometimes be caught from the same camp, *niobe* is clearly only the high level subspecies of *insignis*." This opinion, it seems to me, is contradicted by the seeming absence of intermediates between the two animals on Sumatra proper, and by the similarity of the dark *niobe* to the dark squirrels, *Lariscus siberu* and *L. obscurus*, that occur at sea level on the Mentawi islands off the Sumatran southwest coast.

"This ground squirrel was seen at Meluwak, Kungke and Blangnanga, though it was nowhere plentiful. At Kungke I saw one dart under a large log in a native garden on the edge of the jungle. It uttered a shrill bird-like

chirp similar to that of our American chipmunk (*Tamias*). At 3,800 feet, near Blangnanga, in hilly, rocky jungle I shot one on a fallen log; but it was too badly torn to preserve. I did not see any ground squirrels that resembled *Lariscus insignis*."

42. *Ratufa palliata* Miller

Ratufa palliata Miller, Proc. Acad. Nat. Sci. Philadelphia, 1902, p. 147, June 11, 1902 (Type locality, Indragiri River, southeastern Sumatra); Lyon, Proc. U.S. Nat. Mus., vol. 34, p. 635, September 14, 1908 (Aru Bay and Salat Rupat, northeastern Sumatra).

Ratufa bicolor palliata Chasen, Handlist, p. 121, April 1940; Hayman and Holt in Ellerman, Gen. Liv. Rodents, vol. 1, p. 386, June 8, 1940.

20282, ♂ ad., near Meluwak, 1,640 ft.; $359 \times 414 \times 83 \times 20$. Wt. 2 lbs. 15 oz.

20283, ♂ ad., near Meluwak, 1,640 ft.; $362 \times 480 \times 89 \times 24$. Wt. 3 lbs. 5 oz.

20284, ♀ ad., between Blangkedjeren and Agusan; $360 \times 470 \times 80 \times 20$.

Cranial measurements of nos. 20282 and 20284: greatest length, 70.8 and 73.6 condylobasal length, 65.5 and 68.6; diastema, 6.0 and 7.0; interorbital breadth, 30.0 and 29.3; postorbital constriction, 22.9 and 24.7; depth of braincase, 20.0 and 21.0; depth of rostrum at middle of incisive foramina, 17.5 and 17.5; mandible, 44.6 and 48.0; maxillary toothrow (crowns), 13.0 and 14.0; mandibular toothrow (crowns), 14.0 and 15.0.

I can see nothing to distinguish these specimens from those in the original series collected by Abbott at Aru Bay on the east coast, about 40 miles northeast of Mount Löser, and those that he took at the type locality on the Indragiri River somewhat farther away to the southeast.

"Giant squirrels were not very numerous in Atjeh. They were strictly arboreal, keeping to the very tops of the tall jungle trees. While feeding on wild figs and a nut that resembles a very large acorn they made a great commotion, dropping many twigs and small branches. We observed them in the rainforest at Blangnanga, 3,700 feet; but above 4,000 feet they were not seen."

43. *Petinomys hageni* (Jentink)

Sciuropterus hageni Jentink, Notes Leyden Mus., vol. 11, p. 26, January 1889 (Deli); Lyon, Proc. U. S. Nat. Mus., vol. 34, p. 633, December 24, 1907 (Type locality, Aru Bay, Sumatra).

Petinomys hageni hageni Chasen, Handlist, p. 119, April 1940; Hayman and Holt in Ellerman, Gen. Liv. Rodents, vol. 1, p. 302, June 8, 1940.

20287, ♂ ad., near Medan, Deli; $277 \times 243 \times 54 \times 18$. Wt. 10.7 oz.

20289, ♂ ad., " " " $258 \times 226 \times 50 \times 21$. Wt. 14.6 oz.

20288, ♀ ad., " " " $253 \times 247 \times 46 \times 20$. Wt. 12.4 oz.

20290, ♀ ad., " " " $247 \times 244 \times 51 \times 20$. Wt. 12 oz.

Cranial measurements of no. 20287, adult with closed basal suture and slightly worn teeth: greatest length, 54.0; condylobasal length, 52.4; zygomatic breadth, 35.2; least interorbital breadth, 14.5; postorbital constriction, 13.2; greatest depth of skull when resting on a flat surface, 24.0; depth

of rostrum at middle of incisive foramina, 10.0; mandible, 34.6; maxillary tooththrow (crowns), 10.6; mandibular tooththrow (crowns), 11.0.

These specimens, topotypes of the species, are in every way similar to the pair collected by Abbott at Aru Bay in November and December 1905, except that their teeth are slightly larger, a difference that might readily be within the limits of individual variation.

"Three of these lovely flying squirrels were collected in secondary jungle not far from Medan, Sumatra's capital. They were taken in the early evening when their large eyes brilliantly reflected the light of our head lamps. The fourth specimen was collected actually on the outskirts of Medan at 1 o'clock A. M., while it was feeding on the ripe fruit of a mango tree."

44. *Petaurista petaurista marchio* (Thomas)

Petaurista nitida [sic] *marchio*, Thomas, Ann. and Mag. Nat. Hist., ser. 8, vol. 1, p. 251, February 1908 (Type locality, "Si Rambai, Sumatra" = Si Rambas, Tapanuli?).

Petaurista petaurista marchio Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, pp. 28, 75, June 1918.

Petaurista petaurista batuana [sic] Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 7, pt. 4, p. 269, December 1919 (Benkulen; probably not *Petaurista batuana* [sic] Miller, Smithsonian Misc. Coll., vol. 45, p. 27, pl. 2, fig. 3, November 6, 1903. Tana Bala, Batu Islands, off west coast of Sumatra); Hayman and Holt in Ellerman, Gen. Liv. Rodents, vol. 1, p. 285. June 8, 1940.

Petaurista petaurista batuanus Chasen, Handlist, p. 113 (part), April 1940 (not *P. batuana* [sic] Miller).

20286, ♀ ad. Blangnanga, Atjeh (3,600 ft.); $419 \times 469 \times 81$ (70) $\times 35$. Wt. 3 lbs. 14.5 oz. Skull, greatest length, 69.3 (71.1)⁴; condylobasal length, 65.6 (66.2); diastema, 15.0 (15.2); zygomatic breadth, 47.8 (48.8); least interorbital breadth, 14.0 (16.0); postorbital constriction, 18.4 (18.0); greatest depth of skull when resting on a flat surface, 31.5 (32.0); depth of rostrum at middle of incisive foramina, 14.0 (14.4); mandible, 45.0 (46.0); maxillary tooththrow (crowns), 16.4 (15.6); mandibular tooththrow (crowns), 16.4 (15.6); crown of m¹, 4.0×5.5 (4.5×5.0).

This large, long-haired, richly colored flying squirrel more nearly resembles the true *Petaurista petaurista* (Pallas) of western Java (see Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 7, pt. 4, p. 223, June 1918) than it does the animal collected at several localities on the east coast of Sumatra by Abbott and regarded by Dr. Lyon as not distinguishable from *Petaurista batuana* Miller of the Batu Islands off the Sumatran west coast (Proc. U. S. National Museum, vol. 34, p. 634, September

⁴ Cranial measurements in parentheses are those of an adult female (no. 267,399 U. S. N. M.) obtained alive at Siantar, 40 miles inland from Medan by the National Geographic-Smithsonian Institution Expedition to the East Indies, 1937. The animal may have been captured anywhere in the region extending from Siantar to the highlands of Atjeh.

14, 1908). This identification of the East Sumatran *Petaurista* with the Batuan large flying squirrel appears to me, after re-examining the material in the United States National Museum, to have been incorrect. Comparison of 7 skins from the Batu Islands with 8 skins from eastern Sumatra (all collected by Abbott) shows that the animal occurring on the lowlands of eastern Sumatra proper is uniformly more ochraceous than the Batuan form in its general color, a peculiarity that is most noticeable on the under parts of the body and the under side and outer edge of the gliding membrane. The edge of this membrane is indistinctly buff in all of these mainland Sumatran skins, while in the specimens from the Batu Islands it is drab, with, at most, a slight tinge of buff. These differences though not very great are sufficient to mark the population of lowland eastern Sumatra and that of the Batu Islands, off the Sumatran west coast, as two easily separable forms. The animal (not represented in the Vanderbilt Collection) that Abbott found in the lowlands and coastal islands of eastern Sumatra (the *P. batuana* of Lyon, 1908, p. 634, not of Miller, 1903) appears to be nearly related to the one that Thomas, in 1908 (Ann. and Mag. Nat. Hist., ser. 8, vol. 1, p. 250, March 1908) called *Petaurista nitida melanotis* (Gray). Thomas regarded the range of this race as extending over the "Malay Peninsula and neighboring islands" (Perak, Selangor, Malacca, Johore, Singapore, and Pulo Tioman, are localities at which some of the specimens in the British Museum had been collected); but our unfortunate lack of material from the Malay Peninsula prevents me from forming any definite opinion about the true status of the large flying squirrel of the Sumatran east coast.

"This specimen was shot in broad daylight at about 6 A. M., in the trees bordering a watercourse near Blangnanga. The locality was far from the heavy jungle though connected with it by means of the trees that grew in the ravine of a tributary of the Tripa River."

45. *Rattus maerens* (Miller)

Epimys maerens Miller, Proc. Biol. Soc. Washington, vol. 24, p. 26, February 24, 1911 (Type locality, mouth of the Mojeia River, Nias Island).

Rattus rattus maerens Chasen, Handlist, p. 158, April 1940.

- 20414, ♂ ad., Hilisimaetano, South Nias; $164 \times 168 \times 36.5 \times 17.5$. Wt. 4.1 oz.
20418, ♂ ad., Hilisimaetano, South Nias; $173 \times 171 \times 33.0 \times 17.0$. Wt. 5.3 oz.
20420, ♂ juv., Hilisimaetano, South Nias; $159 \times 157 \times 35.5 \times 16.0$. Wt. 3.3 oz.
20413, ♀ ad., Hilisimaetano, South Nias; $158 \times 155 \times 36.0 \times 19.0$. Wt. 4.4 oz.
20415, ♀ ad., Hilisimaetano, South Nias; $169 \times 167 \times 34.0 \times 17.0$. Wt. 4.6 oz.

20416, ♀ ad., Hilisimaetano, South Nias; $165 \times 157 \times 34.0 \times 17.0$. Wt. 3.9 oz.

20417, ♀ ad., Hilisimaetano, South Nias; $159 \times \text{---} \times 37.0 \times 17.0$. Wt. 4.1 oz.

20419, ♀ ad., Hilisimaetano, South Nias; $175 \times 158 \times 35.0 \times 14.0$. Wt. 4.3 oz.

Measurements of largest and smallest adult skulls (♀ no. 20419 and ♀ 20416): greatest length, 42.8 and 39.2; condylobasal length, 40.2 and 37.4; diastema, 11.2 and 10.4; zygomatic breadth, 20.6 and 19.0; interorbital constriction, 6.6 and 6.2; depth of braincase at basal suture, 11.6 and 12.0; depth of rostrum behind incisors, 8.0 and 7.0; mandible, 25.2 and 23.4; maxillary tooththrow (crowns), 7.8 and 7.0; mandibular tooththrow (crowns), 7.0 and 6.0.

This series agrees in every way with the original material collected by Abbott in 1905 (adult female no. 20419 closely resembles the type specimen except that it has a sprinkling of white hairs on its shoulders).

"Taken in scrub growth near native gardens" and "in heavy jungle." Therefore apparently not a frequenter of houses. "*Rattus maerens* was a more progressive type than either *R. batus* or *R. barussanus*, both of which are essentially inhabitants of the thick, old jungle undisturbed by the natives. Besides occurring in the original jungle it occurs in secondary growth and in the scrub edging the native gardens." Abbott caught his specimens in sweet-potato patches, while, in the houses and villages ("kam-pongs"), he found the common wide-ranging Malayan commensal form of *Rattus rattus*.

46. *Rattus blangorum* new species

? *Rattus rattus jalorensis* Dammermann, Treubia, Buitenzorg, vol. 16, pt. 4, p. 426, November 1928 (Korinchi, Sumatra, alt. 700-1400 m.); Chasen, Handlist, p. 152, April 1940 (part).

20348, ♀ yg. ad., Blangnanga, Atjeh (3,600 ft.; $139 \times 161 \times 32 \times 16$. Wt. 2.6 oz.

20349, ♀ ad., Blangnanga, Atjeh (3,600 ft.); $149 \times 175 \times 32.5 \times 18$. Wt. 3.2 oz.

TYPE.—Adult female (teeth much worn), A. N. S. P. no. 20349, collected near Blangnanga Base Camp (alt. 3,600 ft.), Atjeh, north Sumatra, April 5, 1939, by Frederick A. Ulmer, Jr. Original number, 378.

Description.—Like *Rattus maerens* of Nias Island but smaller and with tail longer than head and body (ratio of tail to head and body in the two Atjehan specimens 115.8 and 117.3 as contrasted with extremes of 98.8 and 102.4 in the two males and 90.3 and 98.1 in four of the five adult females from Nias measured by Ulmer); length of tail, 161-175 instead of 155-167; hind foot, 32-32.5 instead of 34-37; greatest length of skull, 36.8-38.4 instead of 40.8-42.4; fur deeper and softer than in *R. maerens* (depth at middle of back about 14 mm. instead of about 9 mm.); color of back, of

sides of body, and of upper surface of feet less darkened than in the Nias animal, a difference that is due chiefly to the greater extent and more yellowish color of the ochraceous-buff areas on the hairs of these parts in the mountain form; under parts light grayish cream-buff, distinctly paler than in *Rattus maerens*; a narrow median longitudinal streak of clear ochraceous-buff on chest; tail uniformly blackish throughout, as in *Rattus maerens*; caudal scale rows about 12 to the centimeter at middle (about 10 to the centimeter in *R. maerens*). Skull and teeth not different from those of *Rattus maerens* except for their smaller size.

This animal, like *R. maerens*, is obviously a member of the *Rattus rattus* group; but it appears to be so completely differentiated from its rather near geographical ally, *Rattus maerens*, and from the lowland Sumatran pale-bellied member of the *Rattus rattus* group (probably the *Rattus rattus* form *jalorensis* of Chasen, Handlist, p. 152; not met with during the Vanderbilt expedition, but represented by 4 specimens in the United States National Museum collected by Abbott on the Mandau and Siak Rivers, East Sumatra) that I prefer to treat it, for the present, as a distinct species. Its relationship to the animal that Mr. Dammermann (Treubia, Buitenzorg, vol. 16, pt. 4, p. 426, November 1928) has recorded from Korinchi under the name *Rattus rattus jalorensis* (*Mus jalorensis* Bonhote, Fasc. Malayenses, Zool., vol. 1, London, p. 28, July 1903; type locality, Nawngchik, 2500 ft., Ban Sai Kan, Patani, southeastern Peninsular Siam) is undoubtedly very close. However, the feet of the two skins from Atjeh are covered with silvery hairs that make the expression "feet dark brown" used by Bonhote in describing the related Peninsular rat seem quite inapplicable to them. Though the feet of the Atjehan specimens are slightly "clouded" by the presence of subterminal dark areas in a few of the hairs on their upper surfaces, the general color of the feet does not at all closely approach the dark, almost blackish, brown of the tail. In the absence of the needed Peninsular material for comparison I prefer to use a binomial name for this Sumatran mountain rat, with the understanding that good series of specimens from Jalor and Sumatra are likely to show that the distinction between the two forms rests on average characters only.

The *Epimys korinchi* of Robinson and Kloss (Journ. Str. Br. Roy. Asiat. Soc., Singapore, no. 73, p. 275, July 1916; *Rattus baluensis korinchi* Chasen, Handlist, p. 159, April 1940) taken on the banks of the Sungei Kring, Korinchi Peak, at an altitude of 7300 feet, is described as a larger and longer-tailed animal than *Rattus blangorum* (adult female, head and body, 166; tail, 224; hind foot, 34; greatest length of skull, 41; ratio of tail to head and body about 133 instead of about 116).

47. *Rattus rattus diardii* (Jentink)

Mus diardii Jentink, Notes Leyden Mus., vol. 2, p. 13, January 1880 (Type locality, western Java).

Rattus rattus form *diardii* Chasen, Handlist, p. 152, April 1940.

20357, ♀ ad., Medan, Deli; $173 \times 198 \times 35 \times 22$. Greatest length of skull, 43.

20358, ♀ imm., Medan, Deli; $150 \times 161 \times 33 \times 17$.

20361, ♀ ad., Medan, Deli; $181 \times 191 \times 35 \times 21$. Greatest length of skull, 42.5.

20359, ♂ imm., Medan, Deli; $151 \times 178 \times 34 \times 17.5$.

20360, ♂ juv., Medan, Deli; 129×128 (imperfect) $\times 32.5 \times 17$.

20421, ♂ ad., Hilisimaetano, Nias; $168 \times 183 \times 37 \times 20$.

20422, ♂ ad., Hilisimaetano, Nias; $180 \times 183 \times 36 \times 22$. Greatest length of skull, 42.0.

Typical examples of the dark-bellied commensal Malayan brown form of *Rattus rattus*. Probably transported by ship from Java.

My measurements of the type specimen, in Leiden, are: head and body (somewhat overstuffed), 210; tail, 190; hind foot with claws, 36; hind foot without claws, 34.

48. *Rattus korinchi* (Robinson and Kloss)

Epimys korinchi Robinson and Kloss, Journ. Straits Branch Roy. Asiat. Soc., Singapore, no. 73, p. 275, July 1916 (Type locality, Sungei Kring, Korinchi Peak, Padang Highlands, West Sumatra).

Rattus baluensis korinchi Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, p. 53, June 1918; Chasen, Handlist, p. 159, April 1940.

20337, ♂ ad., Blangbeke, Atjeh (7,000 ft.); 157 (166)* $\times 219$ (224) $\times 34$ (34) $\times 18.5$. Wt. 3.3 oz.

Cranial measurements: greatest length, 39.6 (41.0)*; condylobasilar length, 37.0 (35.5); nasal, 14 (15.3); diastema, 10.4 (10.9); zygomatic breadth, 18.0 (19.0); interorbital breadth, 6.2; depth of braincase, 10.4; depth of rostrum at middle of incisive foramina, 7.8; mandible, 20.8; maxillary toothrow (crowns), 7.0 (7.9); mandibular toothrow (crowns), 7.0.

While this rat is doubtless the local representative of the animal that Robinson and Kloss named *Epimys korinchi* in 1916 it is quite possible that series of specimens from Korinchi and Atjeh would show that the two populations represent different local forms. The more elongate tail of the specimen from Atjeh (ratio to head and body about 100 instead of about 140) seems unlikely to be a mere individual feature. The same is true of the shorter maxillary toothrow: 7.0 in no. 20337 as compared with 7.9 in the type specimen.

In size and in general appearance the specimen from Blangbeke resembles the type of *Rattus barussanus* (Miller, Proc. Biol. Soc. Washington, vol. 24, p. 26, February 24, 1911) collected by Abbott on the bank of the Mojeia River, Nias (*Rattus cremoriventer barussanus* Chasen, Handlist, p. 175). Though of the same size and general appearance as the Nias animal it differs in its sharply bicolor tail (that of *R. barussanus* is strictly unicolor) and in the extreme slenderness of the spines on its back. These

* Measurements in parentheses are those of the type specimen (Robinson and Kloss, 1916, p. 275).

spines, though easily seen to be about as numerous as in *R. barussanus*, are so slender that they are not evident to the touch when the fur is rubbed the wrong way, while those in the Nias animal are fully $\frac{1}{2}$ mm. in width. The skull differs slightly from that of *Rattus barussanus* in its somewhat shallower, narrower rostrum, and narrower interpterygoid space.

49. *Rattus* spp. (*R. concolor* group)

20350, ♀ juv., Blangnanga, Atjeh (3,600 ft.); $70 \times 72 \times 20 \times 10$. Wt. 0.4 oz.

20351, ♀ juv., Blangnanga, Atjeh (3,600 ft.); $74 \times 75 \times 20 \times 11$. Wt. 0.4 oz.

20423, ♀ imm., Hilisimaetano, Nias, sea level; $119 \times 133 \times 25 \times 16$. Wt. 1.6 oz.

20424, ♂ imm., Hilisimaetano, Nias, sea level; $103 \times 124 \times 25 \times 16$. Wt. 1.0 oz.

These *concolor* rats are too young for exact identification. In the skins from Nias the adult pelage is beginning to appear on head and shoulders. It is paler, and more yellowish than in two from Tarussan Bay, Sumatra (nos. 141,064 and 141,065 U. S. N. M.), thus agreeing with the color of the specimens that Abbott collected on the neighboring Simalur Island (*Mus surdus* Miller, Proc. U. S. Nat. Mus., vol. 26, p. 460, February 3, 1903; *Rattus concolor surdus* Chasen, Handlist, p. 160, April 1940). The skulls and teeth are not distinguishable from those of two specimens from Simalur Island (nos. 121,507 and 114,186 U. S. N. M.) of about equal immaturity. In the two very young individuals taken at the Blangnanga Base Camp the third molars are still concealed within their alveoli. Whether these young rats represent the same form as Abbott's specimens from Tarussan Bay (*Mus ephippium* Jentink, Notes Leyden Museum, vol. 2, p. 15, 1879, "Sumatra", no exact locality; *Rattus concolor ephippium* Chasen, Handlist, p. 160, April 1940) or a peculiar highland race is a question that is not now possible to answer.

50. *Rattus hoogerwerfi* Chasen

Rattus hoogerwerfi Chasen, Treubia, Buitenzorg, vol. 17, pt. 3, p. 496, August 1939; vol. 17, pt. 5, 496, December 1940 ("Blang Kedjeren", 2,900 ft., Atjeh, Sumatra. Mr. Ulmer tells me that this is probably an error, as the animal appears to be confined to the higher regions.); Handlist, p. 159, April 1940.

Measurements of 10 adults of each sex:

20292, ♀ ad., Blangbeke, Atjeh (7,000 ft.); $178 \times 242 \times 36.5 \times 19$. Wt. 4.3 oz.

20297, ♀ ad., Blangbeke, Atjeh (7,000 ft.); $173 \times 228 \times 37.0 \times 21$. Wt. 4.4 oz.

20300, ♀ ad., Bivouac 3, Atjeh (8,300 ft.); $188 \times 234 \times 38.0 \times 23$. Wt. 4.9 oz.

20301, ♀ ad., Bivouac 3, Atjeh (8,300 ft.); $196 \times 242 \times 38.0 \times 23$. Wt. 5.1 oz.

- 20302, ♀ ad., Bivouac 4, Atjeh (9,100 ft.); $183 \times 246 \times 37.0 \times 23$. Wt. 4.6 oz.
- 20308, ♀ ad., Bivouac 5, Atjeh (7,900 ft.); $189 \times 239 \times 36.0 \times 23$. Wt. 5.4 oz.
- 20309, ♀ ad., Bivouac 5, Atjeh (7,900 ft.); $182 \times 248 \times 37.5 \times 21$. Wt. 5.1 oz.
- 20313, ♀ ad., Bivouac 6, Atjeh (7,950 ft.); $170 \times 243 \times 38.0 \times 24$. Wt. 4.6 oz.
- 20319, ♀ ad., Bivouac 8, Atjeh (8,600 ft.); $182 \times 242 \times 36.0 \times 22$. Wt. 5.0 oz.
- 20320, ♀ ad., Bivouac 8, Atjeh (8,600 ft.); $179 \times 225 \times 36.0 \times 23$. Wt. 4.0 oz.
- 20293, ♂ ad., Blangbeke, Atjeh (7,000 ft.); $165 \times 232 \times 36.5 \times 19$. Wt. 4.2 oz.
- 20295, ♂ ad., Blangbeke, Atjeh (6,800 ft.); $181 \times 237 \times 36.5 \times 24$. Wt. 5.3 oz.
- 20296, ♂ ad., Blangbeke, Atjeh (6,800 ft.); $181 \times 223 \times 37.5 \times 22$. Wt. 4.6 oz.
- 20298, ♂ ad., Bivouac 3, Atjeh (8,300 ft.); $177 \times 227 \times 37.0 \times 22$. Wt. 4.4 oz.
- 20299, ♂ ad., Bivouac 3, Atjeh (8,300 ft.); $193 \times 235 \times 37.0 \times 23$. Wt. 4.8 oz.
- 20306, ♂ ad., Bivouac 5, Atjeh (7,900 ft.); $182 \times 229 \times 38.0 \times 23$. Wt. 4.9 oz.
- 20311, ♂ ad., Bivouac 5, Atjeh (7,900 ft.); $185 \times 255 \times 39.0 \times 25$. Wt. 5.3 oz.
- 20312, ♂ ad., Bivouac 6, Atjeh (7,950 ft.); $183 \times 257 \times 38.5 \times 20$. Wt. 4.8 oz.
- 20315, ♂ ad., Bivouac 6, Atjeh (7,950 ft.); $189 \times 241 \times 39.0 \times 23$. Wt. 4.5 oz.
- 20318, ♂ ad., Bivouac 7, Atjeh (9,300 ft.); $174 \times 226 \times 38.0 \times 23$. Wt. 4.1 oz.

Range of variation: ♀, head and body, 173–196; tail, 225–248; hind foot, 36–38; ear from crown, 21–23; weight, 4.0 oz.–5.4 oz.; ♂, head and body, 165–191; tail, 223–257; hind foot, 36.5–39.0; ear from crown, 19–25; weight, 4.1 oz.–5.3 oz.

Other specimens 9, as follows: 1 from Blangbeke, 2 from Bivouac 4, 3 from Bivouac 5, 1 from Bivouac 6, 2 from Bivouac 7; total, 29.

Cranial measurements of largest and smallest adult female skulls (nos. 20301 and 20302) and largest and smallest adult male skulls (nos. 20303 and 20299): greatest length, ♀, 43.6 and 41.0; ♂, 44.0 and 41.8; condylo-basal length, ♀, 40.6 and 39.6, ♂, 40 and 40; nasal, ♀, 16.0 and 15.0, ♂, 16.4 and 15.0; diastema, ♀, 11.8 and 11.8, ♂, 12.6 and 11.8; zygomatic breadth, ♀ 21.0 and 21.0, ♂, 21.2 and 20.2; interorbital constriction, ♀, 6.2 and 6.0, ♂, 6.0 and 6.0; breadth of braincase above roots of zygomatic, ♀, 16.6 and 17.0, ♂, 17.6 and 17.2; depth of braincase in front of basal suture, ♀, 11.2 and 12.0, ♂, 12.0 and 11.8; depth of rostrum at front of incisive foramina, ♀, 7.8 and 7.6; ♂ 8.0 and 7.4; mandible, ♀, 24.2 and

23.4; ♂, 24.0 and 24.0; maxillary toothrow (alveoli), ♀, 7.8 and 7.8, ♂, 7.8 and 7.8; mandibular toothrow (alveoli), ♀, 7.2 and 7.6, ♂, 7.6 and 7.6.

The Atjehan mountain rat is a member of the peculiar group (nearly related to *Rattus rattus* and its common Malayan representatives) that includes the Celebean *Rattus xanthurus* (Gray), *R. celebensis* (Gray), *R. marmosurus* (Thomas), and *R. hamatus* (Miller and Hollister), as well, apparently, as the Philippine *R. everetti* (Günthür) and the *R. macleari* (Thomas) of Christmas Island. Its fur has about the same (or slightly more pronounced) soft, woolly quality, as that of *Rattus marmosurus* (7 specimens collected in April 1916, on Gunong Kalabat, Minahassa, Celebes, by Mr. H. C. Raven, and presented to the United States National Museum by W. L. Abbott) except that the scattered black hairs on the back and on the upper part of the sides are rarely more than 30 mm. in length, while in the Celebean animal their length often exceeds 50 mm.

The whitish terminal part of the tail is uniformly less extensive in *Rattus hoogerwerfi* than in *R. marmosurus*, covering about half instead of nearly three-fourths of the tail's entire length. In *Rattus hoogerwerfi* no. 20312 the white occupies 62.2 percent of the tail's entire length; in no. 20293 it occupies only 42.2 percent. These two individuals appear to represent the extremes of this variation in the Sumatran series. In four specimens of *Rattus marmosurus* the pale area occupies 70.1, 72.4, 73.7 and 75.5 percent of the tail's entire length, while in Mr. Raven's two specimens of *R. hamatus* it occupies 48.4 and $45 \pm$ percent. The only specimen of *Rattus xanthurus* in the United States National Museum (identified by Oldfield Thomas, April 23, 1921) has the tail so discolored that the limits of the dark and light areas cannot be seen (no. 200,259, Kwandang, Celebes. Raven).

The general color of *Rattus hoogerwerfi* is much more ochraceous than that of *R. marmosurus*. It is intermediate between the ochraceous and ochraceous buff of Ridgway (1886), rather heavily sprinkled with blackish hair-tips on the back, less so on the sides; under parts without black hair-tips, but with the buff slightly clouded by the irregular appearance at the surface of the slaty under color. Dorsum of manus and pes thinly clothed with short, dark-brown hairs; a sprinkling of minute silvery hairs along sides of metatarsals and at bases of claws; sides of muzzle drab on the areas from which spring the nearly black vibrissae; dark area of tail a very dark brown, darker than the brown on the feet. In *Rattus marmosurus* the arrangement of the colors is the same, but the buff element is lighter (between the ochraceous-buff and cream-buff of Ridgway, 1886), and the clear light cream-buff of the under parts causes the belly to be much more noticeably contrasted with the back and sides than is the case with the Sumatran animal. Feet mostly whitish, irregularly drab-washed on the metapodials. Dark area of tail an indefinite drab.

The skull of *Rattus hoogerwerfi* resembles that of *R. marmosurus* (see Pl. 3, figs. 3, 4) in a general way but differs from the skull of the Celebean animal in its broader, relatively shallower braincase (ratio of cranial width above zygomatic roots to depth of braincase when skull is resting on a flat surface ranging from about 115 to 123 instead of from about 102 to 110.6) and by the slight but usually obvious angulation of the supraorbital ridges (in adults with worn teeth) at the points where these ridges cross the coronal suture. Auditory bullae noticeably smaller than in the Celebean rat, but not distinctive in form. The anterior border of the interpterygoid space usually lies a little behind the level of the posterior limits of the toothrows instead of extending slightly in front of this level as it does in *Rattus marmosurus*.

Teeth like those of *Rattus marmosurus* and *R. rattus*.

In color the series is very uniform. Such variation as occurs is mostly confined to the abundance of the long, black-tipped hairs on the back, and to the length of the whitish area on the tail (from 70 mm. in ♂ no. 20293 to 150 mm. in ♀ no. 20309, both animals fully adult with flattened tooth-crowns; the more usual lengths of the white area are between 100 mm. and 135 mm.). There is a slight variability in the amount of yellow in the buffy-brown of the sides and back as well as in the heaviness of the sprinkling of black-tipped hairs, these hairs tending in some specimens to be concentrated near the base of the tail. The intensity of the buff wash on the under parts is somewhat variable (it is especially light in ♂ no. 20293 and in ♀ no. 20297, both animals fully adult with flat-worn molar crowns).

This highland rat is one of the most interesting of the mammals met with during the course of the expedition. Nothing like it was collected by Abbott in his many years' work on the Sumatran coast and outlying islands. As Mr. Chasen has pointed out (Treubia, vol. 17, pt. 3, p. 208, August 1939) the peculiar *Lenothrix canus*, which Abbott discovered on Pulo Tuangku, Banjak Islands (off the Sumatran coast southwest of Nias), has some resemblance to the Atjehan animal. It is, however, a larger rat (head and body, 236; tail, 298; hind foot, 42; greatest length of skull, 49.6), and only the terminal third of its tail is whitish. Furthermore the skull of *Lenothrix*, with its narrow braincase, conspicuous supraorbital ridges, small, peculiarly-formed auditory bullae, and somewhat *Lenomys*-like teeth, is highly distinctive, as may be seen by the photographs on Plate 3 (figs. 7 and 8). I continue to regard the animal as generically distinct from *Rattus*.

In discussing the systematic position of this rat Mr. Chasen came to the conclusion that "perhaps the nearest relative of *Rattus hoogerwerfi* is *Rattus baluensis korinchi*" notwithstanding the facts that the latter animal has a conspicuously dorso-ventrally bicolored tail, and, when its skull is viewed

from the side the relatively much smaller auditory bullae do not extend below the backwardly prolonged level of the molar crowns. Moreover, the cusps of the outer row in the upper molars of *R. b. korinchi* are, as in *Rattus rajah*, *R. whiteheadi* and their allies, smaller (relatively to the cusps of the inner row) than they are in *R. hoogerwerfi*, *R. marmosurus* and *R. rattus*.

51. *Rattus atchinus* new species

20355, ♂ ad., Blangbeke, Atjeh (6,800 ft.); $276 \times 333 \times 62.5 \times 24$. Wt. 22.7 oz.

20356, ♀ ad., Bivouac 5, Atjeh (7,900 ft.); $263 \times 304 \times 60.0 \times 24$. Wt. 18.4 oz.

Cranial measurements (those of no. 20355 stand first): greatest length, 63 and 61; condylobasal length, 59.0 and 58.0; nasal, 24.8 and 24.8; greatest breadth of both nasals together, 7.0 and 7.0; diastema, 18.0 and 17.0; palatal length, 30.4 and 29.8; zygomatic breadth, 32.0 and 32.0; interorbital constriction, 8.6 and 8.0; breadth of braincase above roots of zygomata, 23.0 and 23.0; depth of braincase in front of basal suture, 16.0 and 15.4; depth of rostrum at front of incisive foramina, 12.8 and 12.0; mandible, 38.6 and 37.0; maxillary tooththrow (alveoli), 11.0 and 11.8, (crowns), 10.4 and 11.2; mandibular tooththrow (alveoli), 11.0 and 11.4; crowns, 10.4 and 10.2; width of m^1 , 3.5 and 3.3.

TYPE.—Adult male (teeth moderately worn), A. N. S. P. no. 20355, collected at Blangbeke Base Camp (alt. 6,800 ft.), Atjeh, north Sumatra, April 13, 1939, by Frederick A. Ulmer, Jr. Original number, 390.

Diagnosis.—A member of the *Rattus mülleri* group larger than any of the forms hitherto described from Sumatra; fur unusually dense and woolly.

Description.—Size noticeably exceeding that of the lowland Sumatran forms described as *Mus mülleri* Jentink (Notes Leyden Museum, vol. 2, p. 16, January 1880, Singalan River, West Sumatra), *Mus domitor* Miller (Proc. U. S. Nat. Mus., vol. 28, p. 461, February 3, 1903, Pulo Mansalar, at entrance to Tapanuli Bay, West Sumatra), *Epimys mülleri campus* Robinson and Kloss (Journ. Straits Branch Roy. Asiat. Soc., Singapore, no. 73, p. 275, July 1916, Pasir Ganting, West Sumatra), and *Rattus virtus* Lyon (Proc. Biol. Soc. Washington, vol. 29, p. 219, September 22, 1916, Siak River, near mouth of Gasip River, East Sumatra) and even slightly greater than that of the type specimen of *Epimys victor* Miller (Smithsonian Misc. Coll., vol. 61, no. 21, p. 16, December 29, 1913, from Rumpin River, Pahang; regarded by Chasen, Handlist, p. 163, April 1940, as identical with the *Mus validus* of Miller, 1900, from Trong, Peninsular Siam). Fur deeper and more woolly in texture than that of the lowland members of the *Rattus mülleri* group; depth of body fur in lumbar region about 30 mm.; longer black hairs about 50 mm. as compared with about 10 mm. and 20 mm. respectively in the type specimen of *Rattus mülleri* (which I measured in Leiden, December 1904; for details see Miller in Lyon, Proc. U. S. National Museum, vol. 34, pp. 646-647, September 14, 1908) and about 15 mm. and 20 mm. in the type of *R. virtus*; longest rectal vibrissae about 80 mm. as

compared with 50 mm. in the type of *R. virtus* and 63 mm. in the type of *R. victor*. Color of upper parts and sides a drabby brown, darkest and clearest along the median dorsal area, becoming lighter and more grizzled by the buffy tips (about 1.5 mm.) of the hairs that form the main body-covering on sides of body and outer surfaces of legs; face, muzzle and chin slightly darker than back, finely grizzled behind the clear, dark area that extends from muzzle about half-way to eyes; under parts and inner surfaces of legs pale "ecru-drab" (Ridgway, 1886) with buffy reflections in some lights.

The skull differs from that of the largest among about 150 skulls of members of the *Rattus mülleri* group in the United States National Museum, namely the type of *Rattus victor* (a female with teeth somewhat more worn than those of either specimen from Atjeh), in its slightly greater size (greatest length, ♂, 63 mm., ♀, 61 mm. as compared with 59.4 mm.; breadth of braincase above roots of zygomatic, ♂, 22.1 mm., ♀, 23.3 mm., as compared with 20.6 mm.; zygomatic breadth, ♂, 32.0, ♀, 31.8, as compared with 29.1 mm.) and broader braincase (ratio of cranial breadth above roots of zygomatic to distance from stephanion to posterior border of interparietal 121 in both of the Atjeh specimens, but only 114 in the type of *R. victor*, and 115 in the type of the lowland East Sumatran *R. virtus*).

Teeth more robust than in other members of the *Rattus mülleri* group, but not peculiar in form.

Though this large rat is clearly a mountain representative of the *Rattus mülleri* group I think it should be treated as a distinct species until intergradation with some lowland animal shall have been shown to take place. The peculiarities that separate the Atjehan mountain rat from the relatively small *Rattus mülleri* (Jentink) of the Singalang River, Padang, western Sumatra (head and body of the type specimen, measured in Leiden, December 1904, 185 mm.; tail, 235; hind foot with claws, 44.6; hind foot without claws, 41) and from the nearest geographical neighbor of both *R. mülleri* and *R. atchinus*, the *R. domitor* (Miller) of Pulo Mansalar, off Tapanuli Bay, seem too great to warrant the assumption of intergradation in the absence of specimens proving that intergradation actually takes place.

52. *Rattus setiger* (Robinson and Kloss)

Epimys setiger Robinson and Kloss, Journ. Straits Branch Roy. Asiat. Soc., Singapore, no. 73, p. 271, July 1916 (Type locality, Barong Bharu, west side of Barisan Range, Korinchi, West Sumatra. Altitude, 4,000 ft.).

Rattus ciliatus setiger Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, p. 42, June 1918.

Rattus edwardsi setiger Chasen, Handlist, p. 182, April 1940.

20352, ♂ ad., Meluwak, Atjeh (2,100 ft.); 271 × 380 × 50 × 26. Wt. 16 oz.

20353, ♀ ad., Blangnanga Base Camp (3,600 ft.); 224 × 355 × 46.5 × 25. Wt. 11.5 oz.

20354, ♂ ad., Blangnanga Base Camp (3,600 ft.); 262 × 378 × 56.5 × 25. Wt. 21 oz.

Cranial measurements of ♂ no. 20352 and ♀ no. 20353, both fully adult, the male with slightly the more worn molars; greatest length, 59.8 and 54.2; condylobasilar length, 52.0 and 45.8; nasal, 24.0 and 20.0; diastema, 17.2 and 14.2; zygomatic breadth, 27.6 and 25.2; interorbital constriction, 8.8 and 8.0; breadth of braincase above roots of zygomata, 21.5 and 20.0; depth of braincase in front of basal suture, 14.0 and 13.6; depth of rostrum at front of incisive foramina, 11.8 and 10.0; mandible, 33.0 and 30.0; maxillary tooththrow (alveoli), 10.0 and 9.2; mandibular tooththrow (alveoli), 10.4 and 9.6.

Except for the smaller size of the female (no. 20353) these specimens answer so closely to the descriptions of *Epimys setiger* published by Robinson and Kloss that they furnish no reason for thinking that the Atjehan form is distinct. Even the small mid-ventral dark streak mentioned in the original description of *Epimys setiger* is present in the two males (about 30 mm. by 4 mm. in no. 20352 and 50 by 5 in no. 20354) though I can find no trace of it in the female (perhaps obliterated by the median incision in the skin).

In color *Rattus setiger* differs from the lowland Sumatran members of the *Rattus edwardsi* group in the less buffy general tone of the back, sides, and under parts, a peculiarity that is especially evident in comparison with skins from Tapanuli Bay on the west coast and from Aru Bay on the east coast. This reduction in its buff element makes the general color of the back and sides extremely similar to that in a skin of *Rattus ciliatus* (Bonhote) from Bukit Fraser, Selangor (no. 171,978 U. S. N. M.) and in specimens of *Rattus edwardsi* (Thomas) from Yen-ping-fu, Fukien, southeastern China (U. S. N. M.).

The three Atjehan specimens show much variation in the coloring of the tail. In no. 20354 (♂) the entire tail, (both scales and hairs) is a uniform very dark brown except on the terminal 15 mm. where the color of the very minute hairs changes rather abruptly to white and that of the scales becomes an indefinite pale horn color. In no. 20352 (♂) the scales on the entire under side of the tail are dull whitish and all or nearly all the minute hairs of this area are white, while the dark scales of the upper side are sprinkled with inconspicuous white hairs throughout the distal half of the tail; but neither the scales nor the hairs are pale enough to give the tail a genuinely bicolored appearance. In no. 20353 (♀) the tail is definitely bicolored, though not conspicuously so, the scales of its ventral half whitish and sprinkled with minute white hairs, those of the dorsal half dark brown, sprinkled with minute brown hairs over proximal half of tail and with minute white hairs over the entire distal half. In this specimen the tail is genuinely but not markedly bicolor with a white tip.

The skulls from Atjeh are distinctly larger than those from Tapanuli Bay (greatest length 59.1 and 58.7 in the two males, 54.2 in the female, as

compared with 55.2 in the type specimen of *Rattus vociferanus tapanulius* Lyon, Proc. Biol. Soc. Washington, vol. 29, p. 209, September 22, 1916, a male with moderately worn teeth, 55.5 in a male topotype, no. 114,454 U. S. N. M., and 50.5 in a female topotype, no. 114,455 U. S. N. M., both with moderately worn teeth). They also exceed in length the type (male) skull of *Epimys ululans* Robinson and Kloss from Korinchi (Journ. Straits Branch Roy. Asiat. Soc., no. 73, p. 272, July 1916; greatest length of skull, 53.5), a rat that was regarded as identical with *Rattus vociferans tapanulius* by Robinson and Kloss in June 1918 (Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, p. 43), but is now treated as a distinct race by Chasen (Handlist, p. 164, April 1940).

53. *Rattus rajah lingensis* (Miller)

Mus lingensis Miller, Proc. Washington Acad. Sci., vol. 2, p. 206, August 20, 1900 (Type locality, Linga Island off east coast of Sumatra), Proc. U. S. Nat. Mus., vol. 26, p. 463, February 3, 1903 (Tapanuli Bay, western Sumatra); Lyon, Proc. U. S. Nat. Mus., vol. 34, p. 645, September 14, 1908 (Aru Bay, eastern Sumatra).

Rattus surifer lingensis Chasen, Handlist, p. 172, April 1940, (Rhio-Linga Archipelago).

20338, ♀ ad., near Sibolga, Tapanuli (400 ft.); $183 \times 204 \times 43 \times 24$. Wt.

5.6 oz.

20339, ♀ ad., near Sibolga, Tapanuli (400 ft.); $184 \times 192 \times 44 \times 23$. Wt.

5.2 oz.

20340, ♂ ad., near Sibolga, Tapanuli (400 ft.); $189 \times 194 \times 44 \times 21$. Wt.

6.6 oz.

These specimens appear to be identical with those that I recorded from Tapanuli Bay in 1903, and with the series from Aru Bay on the eastern coast determined by Doctor Lyon three years later. On comparing all this material from Sumatra proper with Abbott's original specimens from Linga I can find no peculiarities by which the lowland rats from the two islands may be distinguished from each other.

54. *Rattus rajah similis* (Robinson and Kloss)?

? *Epimys similis* Robinson and Kloss, Journ. Straits Branch Roy. Asiat. Soc., Singapore, no. 73, p. 272, July 1916 (Type locality, Siolak Daras, Korinchi Valley, West Sumatra).

? *Rattus pellax similis* Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, p. 46, June 1918.

? *Rattus rajah similis* Chasen, Handlist, p. 168, April 1940.

20334, ♀ ad., Meluwak, Atjeh (1,600 ft.); $188 \times 201 \times 42.5 \times 21$. Wt.

5.4 oz.

20335, ♂ ad., Blangnanga, Atjeh (3,600 ft.); $176 \times 189 \times 41.5 \times 22$.

Wt. 4.9 oz.

20336, ♀ ad., Blangnanga, Atjeh (3,600 ft.); $181 \times 181 \times 43 \times 23$. Wt.

4.8 oz.

Cranial measurements (extremes) of the highland (*R. rajah similis*) and lowland (*R. r. lingensis*) specimens, all with moderately worn teeth: greatest length, highland, 42.3–44.1, lowland, 45.6–46.7; zygomatic breadth, high-

land, 18.9–19.4, lowland, 19.6–20.8; nasal, highland, 14.6–15.8, lowland, 16.0–18.0; diastema, highland, 11.2–12.2, lowland, 11.5–12.2; distance from mandibular condyle to tip of incisor, highland, 25.0–26.6, lowland, 27.0–29.0.

The two trios of *raja* rats collected by Mr. Ulmer represent slightly differentiated forms: *Rattus raja lingensis* from the neighborhood of Tapanuli Bay and a highland race from Blangnanga (3,600 ft.). One specimen from Meluwak (1,600 ft.) may be an intermediate between the highland and lowland races. The two skins from Blangnanga are distinguishable from all of the many specimens of *Rattus raja lingensis* that I have examined by the brighter, more tawny tone of the entire buff element of the color, and by a tendency to concentrate the intermixture of black along the median 20 mm. of the back. Moreover, they differ conspicuously from the lowland and Meluwak specimens in the slenderness and inconspicuousness of the bristles on the back and sides (width about 0.20 mm. instead of about 0.40 mm. as in the lowland animal) and the practical absence of bristles on the under parts.

In these specimens from Blangnanga the white area of the inner side of the hind leg extends downward to the heel (thus differing from the condition described in the original account of "*Epimys*" *similis*), while that on the inner side of the fore leg is almost overclouded by brown. But the variability of this overclouding (as well as that of the presence or absence of a brown throat patch) is so great in the lowland Sumatran animal that it could only be relied on as a racial peculiarity if supported by the evidence of many skins.

55. *Rattus barussanus* (Miller)

Epimys barussanus Miller, Proc. Biol. Soc. Washington, vol. 24, p. 26, February 24, 1911 (Type locality, Mojeia River, Nias).

Rattus cremoriventer barussanus Chasen, Handlist, p. 175, April 1940.

20425, ♀ ad.,	Hilisimaetano, Nias;	149 × 193 × 30 × —.	Wt. 3.4 oz.
20427, ♀ ad.,	" "	153 × 190 × 30 × 18.	Wt. 4.1 oz.
20428, ♀ ad.,	" "	150 × 193 × 30 × 17.	Wt. 2.5 oz.
20426, ♂ ad.,	" "	148 × 183 × 30 × 15.	Wt. 2.9 oz.

These skins agree in all respects with the original specimens collected by Abbott in March 1905, except that the buffy color of the under parts is somewhat less pronounced. In one of the females (no. 20428) the longer hairs of the sides and upper parts from tail-base to ears have been so completely replaced by bristles as to give the animal a strange, porcupine-like appearance. The same process, though with more slender bristles, has taken place on the under parts from the region just behind the jaws backward to the front of the groins.

"This rat, like *Rattus batus*, was essentially an inhabitant of the thick, old jungle undisturbed by the natives."

56. *Rattus lieftincki* (Chasen)

Rattus bukit lieftincki Chasen, Treubia, Buitenzorg, vol. 17, pt. 3, p. 208, August 1939; Handlist, p. 178, April 1940 (Type locality, Atang Putar, Atjeh, Sumatra, alt. 3000 ft.).

20341, ♂ ad., Blangnanga, Atjeh (3,600 ft.); $143 \times 163 \times 30 \times 14.5$.
Wt. 2.5 oz.

20342, ♂ ad., Blangnanga, Atjeh (3,600 ft.); $145 \times 182 \times 29 \times 15.5$.
Wt. 2.5 oz.

20343, ♂ ad., Blangnanga, Atjeh (3,600 ft.); $138 \times 28+ \times 28.5 \times 16$.
Wt. 2.5 oz.

20345, ♂ ad., Blangnanga, Atjeh (3,600 ft.); $149 \times 183 \times 29 \times 16$.
Wt. 2.5 oz.

20347, ♂ ad., Blangnanga, Atjeh (3,600 ft.); $126 \times 159 \times 27 \times 15$.
Wt. 1.8 oz.

20344, ♀ ad., Blangnanga, Atjeh (3,600 ft.); $136 \times 157 \times 28 \times 13.5$.
Wt. 1.6 oz.

20346, ♀ ad., Blangnanga, Atjeh (3,600 ft.); $138 \times \text{---} \times 28 \times 17$.
Wt. 1.9 oz.

Cranial measurements of ♂ ad. no. 20342 and no. 20345, both with teeth much worn and basal suture closed; measurements in parenthesis are those of an equally old specimen (♂ no. 258,064 U. S. N. M.) of *Rattus fulvescens huang* (Bonhote) from Yen-ping-fu, Fukien, southeast China: greatest length, 36.2 and 37.1 (36.2); condylobasal length, 33.6 and 34.0 (32.4); nasal, 13.6 and 14.4 (13.4); diastema, 9.2 and 9.2 (9.0); zygomatic breadth 16.2 and $17 \pm$ (16.0); interorbital constriction, 5.4 and 5.6 (6.0); breadth of braincase above roots of zygomatics, 14.2 and 15.0 (15.0); depth of braincase in region of basal suture, 10.0 and 10.0 (10.0); depth of rostrum at front of incisive foramina, 7.0 and 7.0 (6.8); mandible, 20.0 and 20.0 (19.4); maxillary tooththrow (alveoli), 6.0 and 6.0 (5.8); mandibular tooththrow (alveoli), 6.0 and 5.8 (5.4).

In the absence of specimens of *Rattus bukit* from the Malay Peninsula I prefer to use a binomial name for the Atjehan member of the *Rattus fulvescens* group. As compared with *R. fulvescens huang* (of which the United States National Museum contains a series of 36 skins collected 20 years ago by Arthur de C. Sowerby in the region about 70 miles southwest of Yen-ping-fu, Fukien, China), *Rattus lieftincki* differs in its less elongated tail (ratio of tail to head and body varying from about 123 to 126 instead of from 140 to 148) and in the less yellowish, more finely blended buff and black of its sides and upper parts. The skulls of the two animals are not certainly distinguishable from each other except perhaps by a slight tendency in the Chinese rat for the anterior part of the choanae to become somewhat widened, though to a much less degree than is characteristic of the choanae in the allied *Rattus cremoriventer* and *R. barussanus*.

57. *Rattus asper* (Miller)

Mus asper Miller, Proc. Biol. Soc. Washington, vol. 13, p. 145, April 21, 1900 (Trong, Peninsular Siam, alt. 1000 ft.).

Mus asper Lyon, Proc. U. S. Nat. Mus., vol. 34, p. 644, September 14, 1908 (Aru Bay and Siak River, eastern Sumatra).

Rattus whiteheadi asper Chasen, Handlist, p. 181, April 1940.

20321, ♂ ad., near Meluwak, Atjeh (1,600 ft.); $121 \times 104 \times 29 \times 15$. Wt. 2.1 oz.

20322, ♂ ad., Kungke, Atjeh (3,100 ft.); $126 \times 115 \times 31$. Wt. 2.1 oz.

Skull, greatest length, 32.0 and 33.6; zygomatic breadth, 14.0 and 16.0; diastema, 7.8 and 8.0; distance from mandibular condyle to tip of lower incisor, 18.8 and 20.0. In two adult males from Little Siak River, Sumatra (nos. 144,237 and 144,246 U. S. N. M., collected by W. L. Abbott), greatest length, 32.4 and 32.0; zygomatic breadth, 14.6 and 14.8; diastema, 8.0 and 8.0; mandibular condyle to point of incisor, 20 and 20.

The specimens from Meluwak and Kungke, with their small skulls and coarsely spiny fur, are typical examples of *Rattus asper*.

58. *Rattus hylomyoides* (Robinson and Kloss)

Epimys hylomyoides Robinson and Kloss, Journ. Straits Branch Roy. Asiat. Soc., Singapore, no. 73, p. 273, July 1916 (Type locality, Sungei Kring, Korinchi Peak, West Sumatra. Altitude, 7300 ft.).

Rattus hylomyoides Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, p. 48, June 1918.

Rattus alticola hylomyoides Chasen, Handlist, p. 179, April 1940.

20323, ♂ ad., Blangbeke (7,000 ft.); $132 \times 136 \times 31 \times 18$. Wt. 2.5 oz.

20324, ♂ ad., " (6,750 ft.); $151 \times 141 \times 31.5 \times 17$. Wt. 3.2 oz.

20325, ♂ juv., " (6,800 ft.); $106 \times 115 \times 29.0 \times 16$. Wt. 1.4 oz.

20326, ♀ juv., " (7,050 ft.); $114 \times 102 \times 28.5 \times 15$. Wt. 1.6 oz.

20327, ♀ juv., " (7,000 ft.); $112 \times 105 \times 28.0 \times 16$. Wt. 1.3 oz.

20328, ♀ ad., Bivouac 5 (7,900 ft.); $139 \times 134 \times 31.5 \times 18$. Wt. 2.4 oz.

20329, ♂ ad., " 6 (7,950 ft.); $135 \times 133 \times 31 \times 19$. Wt. 2.4 oz.

20330, ♂ juv., " 6 (7,950 ft.); $118 \times 130 \times 28 \times 16$. Wt. 2 oz.

20331, ♂ ad., " 7 (9,300 ft.); $118 \times 111 \times 27.5 \times 16$. Wt. 1.6 oz.

20332, ♂ ad., " 7 (9,300 ft.); $128 \times 118 \times 29 \times 17$. Wt. 2 oz.

20333, ♂ ad., " 7 (9,300 ft.); $122 \times 113 \times 28.5 \times 17$. Wt. 1.7 oz.

This soft-furred montane member of the *Rattus whiteheadi* group is readily distinguishable from the slightly smaller, bristly-coated *Rattus asper*, of which the United States National Museum contains many specimens collected by Abbott on the Sumatran east coast. In only 2 of the highland skins (males, nos. 20323 from Blangbeke, 7,000 ft., and 20329 from Bivouac No. 6, 7,950 ft.) are the bristles along the middle of the back obvious to the touch (when fur is rubbed the wrong way), and in both of these specimens the extreme slenderness of the bristles as compared with those of the lowland animal is evident. On the other hand, soft-furred individuals of *Rattus asper*, if they ever occur, must be extremely rare. I have never seen one.

Whether or not this Atjehan highland animal is exactly the same as the Korinchian *Epimys hylomyoides* of Robinson and Kloss is a question whose answer must await an opportunity to compare specimens from the two regions.

59. *Rattus batus* (Miller)

Epimys batus Miller, Proc. Biol. Soc. Wash., vol. 24, p. 27, February 24, 1911 (Type locality, Pulo Pinie, Batu Islands, West Sumatra).

Rattus batus Lyon, Proc. U. S. Nat. Mus., vol. 52, p. 458, December 30, 1916 (Nias).

Rattus whiteheadi batus Chasen, Handlist, p. 181, April 1940.

20430 ♂ ad.,	Hilisimaetano, Nias;	124 × 113 × 29 × 16.	Wt. 2.5 oz.
20431 ♂ ad.,	"	131 × 99 × 28 × —.	Wt. 2.1 oz.
20436 ♂ ad.,	"	132 × 106 × 30 × 15.	Wt. 2.1 oz.
20437 ♂ ad.,	"	133 × — × 30.5 × 15.	Wt. 2.1 oz.
20429 ♀ ad.,	Soliga, Nias;	121 × 109 × 28 × 15.5.	Wt. 2.4 oz.
20433 ♀ ad.,	Hilisimaetano, Nias;	133 × 103 × 28 × 14.	Wt. 2.2 oz.

In 1916 Dr. Lyon recorded *Rattus batus* from Nias (collected by Abbott) but without comment. On comparing the specimens brought home by Mr. Ulmer with those in the United States National Museum, from both Nias and the Batu Islands, I am likewise unable to find any peculiarities that suggest the existence of two insular races. These specimens from Nias are slightly lighter colored, both above and below, than those from the Batu Islands, a peculiarity that may be due to their being the more fully stuffed; the gray of their heads and napes is slightly browner and less dark. Maximum and minimum measurements of six specimens from Nias and five from the Batu Islands: Tail vertebrae, Nias, 100–113, Batu, 103–114; hind foot, Nias, 27–30.5, Batu, 29–31; greatest length of skull, Nias, 34–34.4, Batu, 33.6–34.

"This rat, like *Rattus barussanus*, was essentially an inhabitant of the thick, old jungle undisturbed by the natives."

60. *Mus musculus* Linnaeus, subspecies

20362, ♂ ad., near Medan, Deli; 80 × 80 × 17 × 13. Wt. 0.4 oz.

Measurements of skull as compared with those of type specimen (♀ ad. no. 125,213 U. S. N. M., Davao, Mindanao, Philippine Islands) of *Mus commissarius* Mearns, and an adult male *Mus musculus* from London, England (no. 152,820 U. S. N. M.): greatest length, 20.6, 20.4, 21.0; zygomatic breadth, 10.5, 10.5, 11.0; diastema, 5.4, 5.0, 5.4; mandible, 10.8, 11.2, 11.5.

This house mouse appears to be a representative of the animal to which Mearns gave the name *Mus commissarius* (Proc. U. S. Nat. Mus., vol. 28, p. 449, May 13, 1905). A decision as to its exact status must await a thorough-going revision of the oriental members of the house mouse group.

61. *Thecurus sumatrae* Lyon

Thecurus sumatrae Lyon, Proc. U. S. Nat. Mus., vol. 32, p. 583, June 29, 1907 (Type locality, Aru Bay, Sumatra).

Hystrix crassispinis sumatrae Chasen, Handlist, p. 188, April 1940.

20291, ♂ imm., Tanjong Slamet, Deli, basal suture visible, third molar not fully erupted. Head and body, 424; tail imperfect; hind foot with claws, 69; ear (from crown), 20. Skull, greatest length, 93.6; condylobasal length, 87.8; zygomatic breadth, 51.2; least interorbital breadth, 30.0; breadth of braincase between zygomata and auditory bullae, 35.6; depth of braincase (median), 31.0; mandible, 58.1; maxillary tooththrow (alveoli), 20.0; mandibular tooththrow (alveoli), 21.2.

The skin is very similar to the skin of the type specimen collected by Abbott at Aru Bay in 1906. The skull is noticeably smaller than that of the type (greatest length only 93.6 instead of 107.6), a peculiarity that seems to be merely individual in view of the variation in size shown by Abbott's specimens from several points on the Sumatran east coast. The nasal bones and the anterior half of the frontals appear to have been severely injured during the animal's early life.

"Porcupines are known as 'landoks' to the natives, and are highly esteemed as food, especially by the omnivorous Chinese."

62. *Sus vittatus* Müller and Schlegel

Sus vittatus Müller and Schlegel, Verhandel. Natuurl. Gesch. Nederl. overz. Bezitt., Zool., p. 172, 1839-44 (part).

Sus vittatus Jentink, Notes Leyden Mus., vol. 26, p. 175, October 16, 1905 (name restricted to Sumatran animal).

Sus cristatus vittatus Chasen, Handlist, p. 191, April 1940.

20239, ♀ yg. ad., Tretet, Atjeh (3,500 ft.); 1112 × 268 × 255 × 77. Wt. 124 lbs.

20240, ♀ juv., Blangnanga Base Camp (3,600 ft.); 1117 × 103 × 246 × 80. Wt. 120 lbs.

Neither specimen shows any noteworthy peculiarities. Skull of adult female, condylobasal length, 278.0; zygomatic breadth, 124.0; breadth of braincase above roots of zygomata, 66.4; depth of braincase to lower margin of occipital condyles, 105.0; mandible, 243; upper molar-premolar row, 102.6; lower molar-premolar row, 110.6.

"Signs of wild pig were numerous in the rain forest around Meluwak. Along the river the soft earth was rooted up and poked with the holes made by their sharp hoofs. Nearby in secondary growth we passed curious rounded piles of dead vegetation resembling small muskrat houses, which, according to the natives, were made by pigs, although for what purpose I could not ascertain. Pigs were even more numerous in the grassy river bottoms of Blangkedjeren valley where they do some damage to native yam patches. Higher than 3600 ft. they were not seen. Native name 'babi'."

63. *Acrocodia indica* (Desmarest)

Tapirus indicus G. Cuvier, Tabl. Elém. Hist. Nat., p. 152, 1798.

Acrocodia indica Goldman, Proc. Biol. Soc. Washington, vol. 26, p. 65, March 22, 1913.

Tapirus indicus Chasen, Handlist, p. 207, April 1940.

20241, ♂ imm. (third molars below rims of alveoli). Bought from Carl Berthold. Had lived in the Dierenpark at Medan. Skin, skull and skeleton.

Head and body, 2100; height at shoulder, 970. Skull, condylobasal length, 413; zygomatic breadth, 192; breadth of braincase above roots of zygomata, 112; depth of braincase to lower margin of occipital condyles, 122; mandible, 362; upper molar-premolar row (alveoli), 152; lower molar-premolar row (alveoli), 143.

"The Malay tapir is strictly protected by Dutch law in Sumatra; not even scientific institutions being allowed to collect it. Our specimen was one of a pair trapped alive by natives in the swampy lowland jungles of Membang Muda, in the Asahan district, for Carl Berthold. They were exhibited in the Deirenpark at Medan and the mate is still there.

"Carl Berthold, the well-known animal dealer of Medan, has noted that tapirs in the wilds suffer from an eye disease and are often blind.

"The Malay name of 'kuda ayer', for this beast is very appropriate, literally meaning 'water-horse'."

64. *Didermoceros sumatrensis* (G. Fischer)

[*Rhinoceros*] *sumatrensis* G. Fischer, Zoognosia, vol. 3, p. 301, 1814. Based on Bell's "double horned Rhinoceros of Sumatra", Phil. Trans. Roy. Soc. London, vol. 83, p. 3, 1793.

Rhinoceros sumatranus Raffles, Trans. Linn. Soc. London, vol. 13, p. 268, 1822.

Didermoceros sumatranus Hubback, Journ. Mamm., vol. 20, no. 1, p. 1, February 14, 1939.

Rhinoceros sumatrensis Chasen, Handlist, p. 207, April 1940.

20242, ♂ imm., skull only (m^1 and m^2 in place, m^3 below alveolar margin). Condylobasal length, 482; zygomatic breadth, 255; lacrimal breadth, 150; occipital depth thru condyle, 165; mandible, 397; mandibular depth thru coronoid process, 78; maxillary tooththrow (alveoli), 200; mandibular tooththrow (alveoli), $205\pm$.

"Carl Berthold presented to us the skull of an immature two-horned Rhinoceros captured in Atjeh by the natives several years ago. Mr. Berthold obtained a permit from Buitenzorg to keep it in captivity, but before he could reach Atjeh the natives killed it and so he preserved only the skull. Rhinoceroses are close to extinction in northern Sumatra, although a few are supposed to remain in remote parts of the Wilhemina Range. A 'pawong' or native chieftain told us that the animals once were very numerous on the plateau at Blangbeke. Scattered about the blangs we saw many shallow clay-lined pools in which he said the rhinos used to wallow. Some of these depressions were dry, with roots and sods torn up as if by the animals' horns. The pawong and his men hunted the rhinos here twenty years ago, using both guns and dead-falls over the rhino trails. We encountered the remains of a deadfall along the trail to Blangbeke. It consisted of a huge log in which, originally, a sharpened bamboo blade was inserted. This spear was suspended over the trail and the blundering rhino tripped the rattan trigger-cord, releasing the spear. Sometimes natives were killed in these traps. The pawong personally had captured 24 rhinos with

these spike traps. The relentless pursuit of the rhinoceros was spurred by the fabulous prices paid by wealthy Chinese for the horns, bones, blood, and other portions of the animal. Rhinoceros horn is credited by the Chinese with curing all diseases; but they particularly prescribe it as an aphrodisiac. The pawong used to obtain 250 rupees (guilders) for a catty (1.36 lbs.) of powdered horn.

"On the south side of Gunong Löser we entered an area of fire-blasted timber and the pawong said that the rhino-hunters years ago fired the forest to drive the animals down to the valley where they could be slaughtered. He also mentioned that the natives, except when hunting, avoided the rhinoceros-inhabited mountains because truculent rhino bulls often charged unwary travellers.

"A Captain of the Dutch regiment stationed at Blangkedjeren said that in his four years in Atjeh he had seen but one rhino. It was near the west coast and was, curiously enough, the one-horned *R. sondaicus*.

"The small *Didermoceros sumatranus* has poorly developed skin folds, and because of its smooth skin is called in Malay 'badak gajah' (elephant-rhinoceros) or 'badak kerbau' (buffalo-rhinoceros). The larger *Rhinoceros sondaicus* has heavy skin-folds and the entire skin surface is finely seamed, giving it a scaly appearance. Because of this the Malays call it 'badak bersisih' (scaly rhinoceros) or 'badak tenggiling' (pangolin rhinoceros)."

65. *Tragulus napu niasis* Lyon

Tragulus napu niasis Lyon, Proc. U. S. Nat. Mus., vol. 52, p. 455. December 30, 1916 (Type locality, Kwala Mojeia, Nias); Chasen, Handlist, p. 194, April 1940.

20412, ♂ imm. (third molars below margins of alveoli; milk dentition slightly worn), Hilisimaetano, southern Nias; $457 \times 79 \times 132 \times 38$. Skull, greatest length, 99.8; zygomatic breadth, 39.8; mandible, 73.2.

This specimen shows no peculiarities as compared with those of the original material (8 skins) collected by Abbott in 1905.

"Shot at 10 P. M. in thick jungle. Many ticks."

66. *Rusa equina* (Raffles)

Cervus axis Raffles. Trans. Linn. Soc. London, vol. 13, p. 263, 1822 (not of Erxleben, 1777).

Cervus equinus G. Cuvier, Oss. Fossiles, ed. 3, vol. 4, p. 45, 1825 (based on the *Cervus axis* of Raffles and on specimens collected in Sumatra by Diard and Duvaucel; vicinity of Benkulen may be regarded as the type locality).

Rusa equina Gray, List Spec. Mamm. Brit. Mus., p. 179, 1843.

Cervus unicolor equinus Chasen, Handlist, p. 201, April 1940.

20236, ♀ imm., permanent dentition in place, just beginning to wear, Blangbeke Dua (3,700 ft.), Atjeh, May 10, 1939. $1696 \times 189 \times 482$, ear from notch, 169; ear from crown, 200; greatest length of skull, 331; zygomatic breadth, 130; occipital breadth, 96; palatal breadth including first molars, 96.8; length of nasals (median), 98; greatest combined breadth of nasals, 31; ratio of nasal breadth to length, 31.6; length of mandible from

condyle, 263; upper toothrow (alveoli), 110; lower toothrow (alveoli), 114; width of incisiform toothrow (crowns), 43.

20237, ♂ (fetus of no. 20236); $665 \times 65 \times 250 \times 80$.

20408 ♂ ad. (skull only, mandibles lacking; teeth moderately worn), Nias, "from a native house at Hilisimaetano." Greatest length of skull, 360+ (tips of premaxillaries imperfect); zygomatic breadth, 151; occipital breadth, 131; palatal breadth including first molars, 118.3; length of nasals (median), 120.5; greatest combined breadth of nasals, 49.5; ratio of nasal breadth to length, 41.2; upper toothrow (alveoli), 104.6.

20409, ♂ not so old as no. 20408, surfaces of antlers mostly smooth, perhaps artificially polished. Nias, "from a native house in Hilisimaetano."

In the skull no. 20408 the rostrum is remarkably broad as compared with that of the female from Atjeh and with those of the numerous specimens in the United States National Museum collected by Abbott. The teeth of this individual are not so large as those of the female from Atjeh, but the difference is not great enough to seem important. In the second premolars the anterior portion of the crown is so reduced in width and the median cusp is so greatly lessened in size that the remains of these two parts project forward against the posterior border of the first premolar. The grinding surfaces of the teeth are thus given irregularly triangular outlines, symmetrically disposed on the two opposite sides of the palate. Though the perfect bilateral symmetry of this tooth-form gives the appearance of a normal structure such as I have not seen in any other specimen of *Rusa* I think that it, and also the unusual width of the rostrum and nasals, should be regarded as individual variants unless constancy can be shown by their presence in other specimens from Nias.

67. *Muntiacus moschatus* (Blainville)

Cervus moschatus Blainville, Bull. Soc. Philomath., Paris, année 1816, p. 77 ("... provenant de Sumatra, mais sans aucune autre espèce de renseignement").

Muntiacus moschatus Lyon, Proc. U. S. Nat. Mus., vol. 31, p. 582, December 18, 1906 (Sumatra only).

Muntiacus muntjac moschatus Chasen, Handlist, p. 203, April 1940 (Sumatra and Nias).

20410 and 20411, frontlets with antlers. Both obtained from natives at Hilisimaetano, Nias.

These two specimens, together with three frontlets of the same kind presented to the United States National Museum by Abbott (nos. 141,179, 123,158 and 123,159), appear to represent an animal that is smaller than the true Sumatran *Muntiacus moschatus*, of which the United States National Museum contains two skins and skulls, one (no. 141,030) from Tarusan Bay on the southwest coast and the other (no. 143,538) from Aru Bay on the northeast coast, both likewise collected and presented by Abbott. Mr. Chasen includes Nias in the range of the Sumatran animal, but without referring to any actual comparison of specimens.

The length of the metopic suture in no 20411 is 75.5 mm. (in no 20410 the suture is imperfect); in the three Abbott specimens from Nias it ranges

from 68 to 70 mm., while in the two skulls from Sumatra it is 79.6 (Tarus-san Bay) and 81.4 (Aru Bay). These measurements, and the facts that the largest frontlet from Nias (no. 20411) came from an old animal while both of the skulls from Sumatra are so immature as to retain their milk dentitions, make it appear probable that adequate material from the two islands would show the muntjak of Nias to be a distinct form.

68. *Muntiacus montanus* (Robinson and Kloss)?

? *Muntiacus muntjak montanus* Robinson and Kloss, Journ. Fed. Malay States Mus., Singapore, vol. 8, pt. 2, p. 69, June 1918 (Type locality, Sungei Kring, Korinchi Peak, West Sumatra, 7,300 feet); Chasen, Handlist, p. 12, April 1940.

20238, ♂ immature (permanent premolars not fully in place), skull only (mandibles and first left premolar missing; tips of premaxillaries broken off). Part of a skeleton found at 9,300 feet altitude near the summit of Mount Löser. Cranial measurements: greatest length, $174\pm$ (192.4, 193.4⁵); basal length, $165\pm$ (180.0, 180.0); length of metopic suture, 71.0 (81.4, 83.4); diastema, 22.6 (25.4, 26.0); zygomatic breadth, 79.0 (83.2, 86.6); breadth of braincase, 55.8 (60.2, 61.6); breadth of rostrum over canine alveoli, 29.5 (30.0, 30.2); breadth of rostrum at mid-nasal level, 39.4 (34.6, 32.6); breadth of palate including anterior segment of m^1 , 54.0 (60.4, 61.0); horizontal diameter of orbit, 30.0 (34.0, 35.0); vertical diameter of orbit, 30.5 (31.5, 33.0); length of lacrimal from margin of orbit, 27.6 (32.4, 35.6); height of lacrimal, 29.6 (27.0, 29.0); transverse diameter of lacrimal pit, $25\pm$ ($27\pm$, $32\pm$); vertical diameter of lacrimal pit, $27\pm$ ($18\pm$, $21\pm$); length of nasal along median suture, 39.0 (53.0, 52.6); greatest width of both nasals together, 25.0 (23.4, 26.0); ratio of nasal breadth to length, 62.1 (45.6, 44.6); maxillary toothrow (alveoli), 54.0 ($64\pm$, $65\pm$); crown of second upper molar, 10.4×12.8 (12.0×13.0 , 14.0×13.2); height of unworn postero-external prism of second upper molar, measured from base of enamel, 11.0 (13.8, 13.6).

The distinctness of the small Mount Löser muntjak from the large *Muntiacus moschatus* of the Sumatran lowlands is made obvious (1) by the differences in general size of the skulls and teeth, (2) by the larger size (actually as well as relatively) of the lacrimal pit, Pl. 4, (3) by the shortness and relatively greater breadth of the entire rostrum and (4) especially by the shortness and relatively great breadth of the nasal bones.

In size the skull and teeth are about the same as those of the small Bornean muntjak, *Muntiacus pleiharicus* (Kohlbrugge), of which the United States National Museum contains 20 skulls collected by W. L. Abbott, C. F. Adams and Mr. H. C. Raven. Among these Bornean specimens, however, there is none that shows the broadening of the rostrum, the shortening of the nasals and the enlarging of the lacrimal pit that characterize the

⁵ Measurements in parenthesis are: first those of a young male *Muntiacus moschatus* (no. 141,030 U.S.N.M., milk dentition in place, m^3 completely encapsuled) from Tarusan Bay southwest Sumatra, and second those of a slightly less immature male of the same species (no. 143,538 U.S.N.M., milk dentition in place, cusps of m^3 beginning to push beyond alveolar level) from Aru Bay, northeast Sumatra; both collected by Abbott.

skull from Mount Löser. A slight broadening of the rostrum occurs in some skulls of the small Chinese *Muntiacus lacrymans*, notably in no. 239,130 U. S. N. M., from Suifu, Szechuan; but even in this specimen the ratio of greatest breadth of both nasals together to the greatest nasal length between parallel lines is only 41.1 while in the Sumatran no. 20238 it is 61.2. In the Chinese animal the enlargement of the lacrimal pit is even greater than in the Sumatran specimen, usually carrying the anterior margin of the pit forward to a level with the front of the first premolar, while in no. 20238 it scarcely reaches the level of the middle of this tooth.

There seems to be no reason to doubt that the Mount Löser muntjak is a Sumatran representative of *Muntiacus pleiharicus*, but so distinct from the Bornean deer that no intergrading or overlapping of characters can be reasonably expected. On the other hand its relationship to the Korinchian *Muntiacus muntjak montanus* of Robinson and Kloss is, for the present, less easily understood. The only known specimen of this animal was collected on the bank of Sungei Kring at an altitude of 7300 feet in the highlands of Korinchi about 500 miles southeast of Mount Löser. These highlands are separated from the highlands of Atjeh by the relatively less elevated country that lies in the general region of Lake Toba, and that might be sufficiently low to act as a barrier between two montane ungulates. Unfortunately the original description of the species was very inadequate. Its authors wrote: "while of the same general type [as in specimens of *M. m. moschatus* from the Korinchi Valley] the skull and teeth [of *M. m. montanus*] are noticeably smaller, while the lachrymal depression is situated perhaps a little lower on the side of the face." They published no measurements either of the entire animal or of the skull, and they gave no information about the size of the lacrimal depression relatively to the size of the orbit. Under these circumstances, and although it seems quite possible that the small muntjaks of the two mountain areas may eventually prove to be distinct from each other, I prefer for the present to use the name *montanus* for the specimen from Mount Löser.

69. *Manis javanica* Desmarest

Manis javanica Desmarest, Mammalogie, pt. 2, p. 377, 1822; Chasen, Handlist, p. 111, April 1940.

20403, ♂ juv. (cranial sutures open) near Medan, Deli. Head and body, 380; tail, 329; hind foot, 82; median claw (chord), 24.0; median claw of fore foot, 24.8; ear from crown, 8; condylobasal length of skull, 80.0; zygomatic breadth, 27.0; greatest breadth, 32.6; lacrimal breadth, 19.8; greatest depth of braincase, 24.6; depth of rostrum at posterior extremity of premaxillary, 10.0; length of mandible, 54.6.

"The pangolin is said to be common in the plantation country of north-eastern Sumatra. Native name, 'tenggiling'."

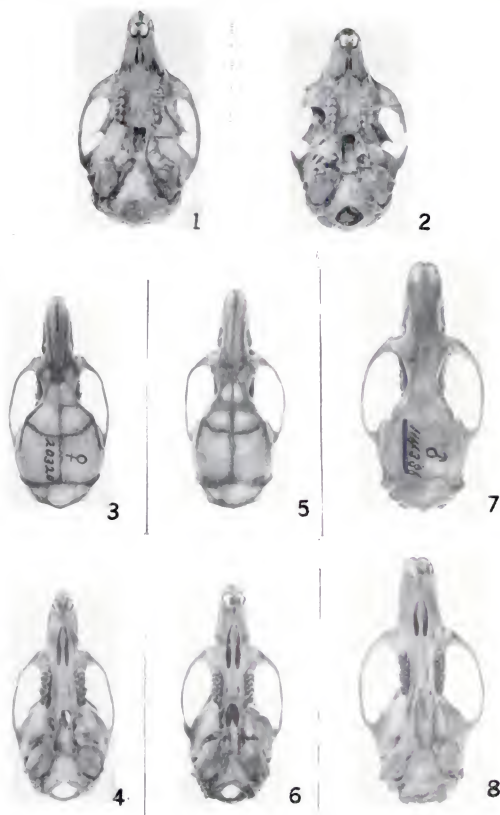
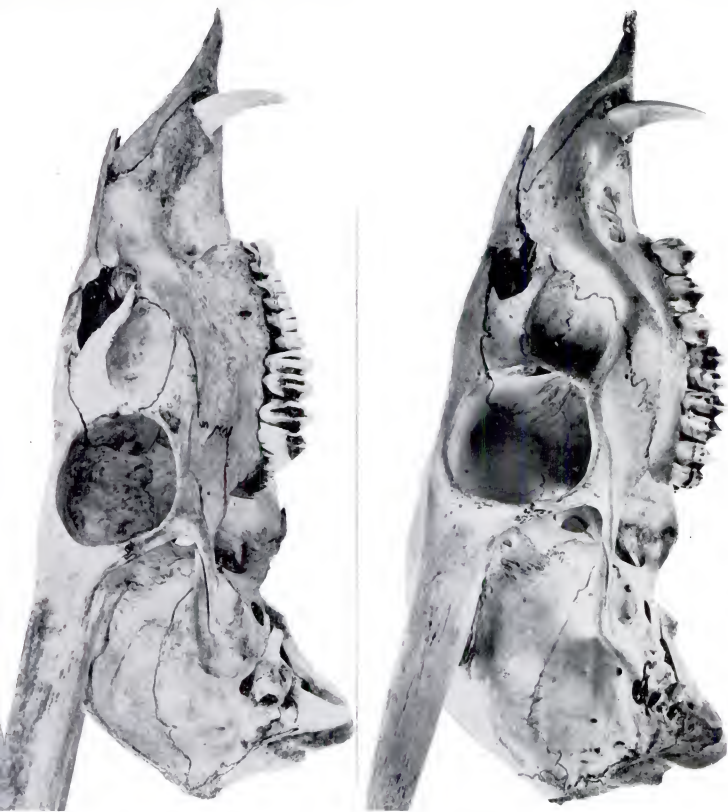


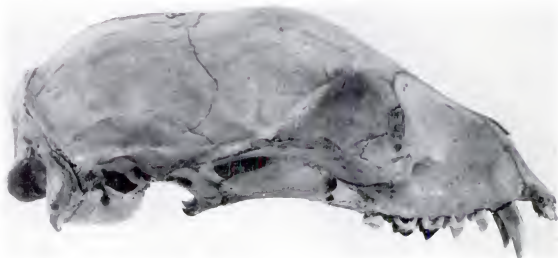
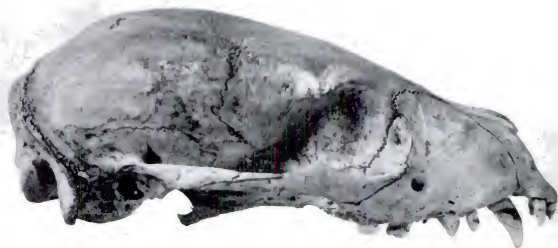
Fig. 1. *Callosciurus altitudinis* (Robinson and Kloss). ♀ no. 20257. Bivouac 5, Atjeh. Fig. 2. *Callosciurus tenuis* (Horsfield). ♀ no. 86,888 (U.S.N.M.). Singapore Island. Figs. 3, 4. *Rattus hoogerwerfi* Chasen. ♀ no. 20320. Bivouac 8, Atjeh. Figs. 5, 6. *Rattus marmosurus* Thomas. ♂ no. 217,788 (U.S.N.M.). Gunung Kalabat, Celebes. Figs. 7, 8. *Lenoithrix canis* Miller. ♂ no. 114,386 (U.S.N.M.). Pulo Tuangku, Banjak Islands, off west coast of Sumatra. (All natural size.)

MILLER: ZOOLOGICAL RESULTS OF THE GEORGE VANDERBILT SUMATRAN EXPEDITION, 1936-1939. PART V.—MAMMALS COLLECTED BY FREDERICK A. ULMER, JR. ON SUMATRA AND NIAS.



Left.—*Muntiacus moschatus* (Raffles). ♂ no. 143,538 (U. S. N. M.). Aru Bay, northeast Sumatra. Right.—*Muntiacus montanus* (Robinson and Kloss)? ♂ no. 20238. Near summit of Mount Löser. (Figures reduced to uniform length, not to same scale.)

MILLER: ZOOLOGICAL RESULTS OF THE GEORGE VANDERBILT SUMATRA-TRAN EXPEDITION, 1936-1939. PART V.—MAMMALS COLLECTED BY FREDERICK A. ULMER, JR. ON SUMATRA AND NIAS.



Above.—*Arctictis niasensis* Lyon. ♀ immature, no. 20407. Purchased at Soliga, central Nias. Below.—*Arctictis binturong* (Raffles). ♂ immature, no. 144,322 (U.S. N. M.). Pulo Tebing Tinggi, eastern Sumatra. (About natural size.)

MILLER: ZOOLOGICAL RESULTS OF THE GEORGE VANDERBILT SUMATRAN EXPEDITION, 1936-1939. PART V.—MAMMALS COLLECTED BY FREDERICK A. ULMER, JR. ON SUMATRA AND NIAS.



Fig. 1. *Felis temminckii* Vigors and Horsfield. Fig. 2. *Nycticebus coucang hilleri* Stone and Rehn. Figs. 3, 4. Tame orangoutangs. Fig. 5. *Rattus hoogerwerfi* Chasen. Fig. 6. Landscape at Blangbeke. (Photographs by Mr. Ulmer.)

MILLER: ZOOLOGICAL RESULTS OF THE GEORGE VANDERBILT SUMA-
TRAN EXPEDITION, 1936-1939. PART V.—MAMMALS COLLECTED
BY FREDERICK A. ULMER, JR. ON SUMATRA AND NIAS.

MIOCENE INVERTEBRATE FAUNA OF NEW JERSEY

BY HORACE G. RICHARDS * AND ANNE HARBISON **

INTRODUCTION AND ACKNOWLEDGMENTS

Little work has been done in recent years on the Miocene formations of New Jersey. The present report attempts to summarize all known data on these sediments and to present a detailed analysis of the invertebrate fauna.

This study is part of a joint undertaking aided by several institutions, in particular by the Academy of Natural Sciences of Philadelphia and the New Jersey Geological Survey and State Museum. The writers wish to express their sincere thanks to these institutions for this cooperation; especially they wish to express appreciation to Dr. B. F. Howell of the Academy and Mr. Meredith E. Johnson, State Geologist of New Jersey, for frequent advice and criticism throughout the preparation of this report. In addition, certain parts of the field work as well as the publication were made possible by a grant from the Johnson Fund of the American Philosophical Society, for which acknowledgment is expressed.

The cost of preparing the plates was shared jointly by the Academy, the New Jersey Geological Survey, the Newark Museum, Princeton University, Rutgers University, and the North Carolina State Museum. Sincere thanks are due these institutions for the cooperation which made this work possible. The photographic work was done by Mr. Allen L. Midyette, Jr., and the senior author.

In order to make the list of species and records complete, New Jersey specimens were borrowed or consulted in the following museums, to which we wish to express appreciation:

American Museum of Natural History, New York, N. Y.
Academy of Natural Sciences of Philadelphia, Philadelphia, Pa.
Historical Museum, Cape May Court House, N. J.
New Jersey State Museum, Trenton, N. J.
Newark Museum, Newark, N. J.
Rutgers University, New Brunswick, N. J.
United States National Museum, Washington, D. C.
Wagner Free Institute of Science, Philadelphia, Pa.

* Associate Curator, Department of Geology and Paleontology, The Academy of Natural Sciences of Philadelphia; Research Associate, New Jersey State Museum, Trenton, N. J.

** Associate Curator, Department of Geology and Paleontology, The Academy of Natural Sciences of Philadelphia.

Dr. Paul Bartsch, of the United States National Museum, permitted us to take photographs of types in that Museum.

To Dr. H. A. Pilsbry, of the Academy, and Dr. Julia Gardner, of the United States Geological Survey, we are indebted for advice on the determination of certain species of mollusks. Also we wish to thank Dr. R. S. Bassler and Dr. T. Wayland Vaughan of the United States National Museum, for the determination of the bryozoa and corals respectively.

We are also indebted to Mr. Harry T. Davis, Curator of the North Carolina State Museum in Raleigh, N. C., for numerous courtesies throughout the work and for making possible a comparison between the New Jersey Miocene fossils and those from North Carolina.

Finally, we wish to express our sincere appreciation to Dr. Julia Gardner, who critically read this manuscript immediately prior to publication.

STRATIGRAPHY OF THE MIOCENE FORMATIONS OF NEW JERSEY

The Miocene sediments of New Jersey are for the most part unconsolidated sands and clays. They are usually divided into two formations, the Kirkwood and the Cohansey.¹ The Kirkwood, which contains many invertebrate fossils and diatoms can definitely be regarded as marine and correlated with other formations to the south and there is no doubt about its age; but the Cohansey has yielded no fossils except a few land plants, and there is some doubt whether it is of late Miocene age or whether it is Pliocene.

Kirkwood Formation

Although it was not described as a distinct formation until 1904² the presence of a Miocene fossiliferous deposit in New Jersey was recognized at least as early as 1868,³ when Cook discussed the "Shiloh Marl" from Cumberland County, N. J.

The Kirkwood beds vary in character in different regions but they are "predominantly fine micaceous quartz sands, in many places delicately banded in shades of salmon pink and yellow."⁴ In the southern part of the State (Cumberland and Salem County) the Kirkwood consists of about 90 feet of chocolate or drab-colored clay above which there are exposures of clayey sand or "marl" containing great quantities of fossils. This is the "Shiloh Marl" of early reports and forms the uppermost bed of the Kirkwood formation.

¹ J. V. Lewis and H. B. Kummel, *The Geology of New Jersey*. N. J. Geol. Surv., Bull. 14, 1915; H. B. Kummel, *idem.*, Bull. 50, pp. 130-131, 1940.

² G. N. Knapp, *Underground Waters, Wells Drilled in 1903*. An. Rept. N. J. State Geol. for 1903, p. 81, 1904.

³ George H. Cook, *Geology of New Jersey*, 1868.

⁴ Lewis and Kummel, 1915, *op. cit.*, p. 71.

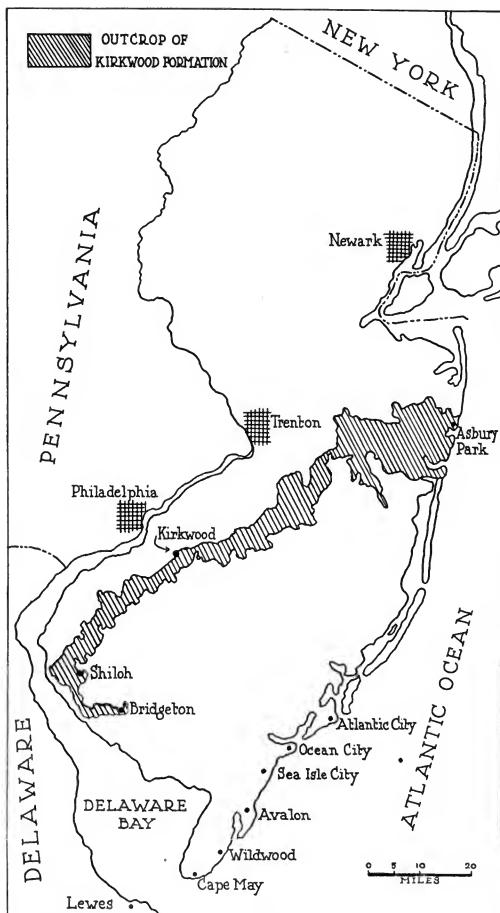


FIG. 1.—Map of New Jersey showing outcrops of the Kirkwood Formation. (Adapted from New Jersey Dept. Conserv. and Devel., Bull. 30.)

The fauna of the "Shiloh Marl" is at least roughly equivalent to that of the Calvert formation of Maryland—which is the lowest of the Chesapeake Group.

At a few places in southern New Jersey there is a consolidated phase of the Kirkwood formation, made up of sandstone or quartzite. This phase is apparently limited to the immediate proximity of the Cohansey Creek and is (or was) probably most abundant near Greenwich, Fairton, and Bridgeton. It is probably this phase that Whitfield occasionally referred to in his paleontological report as the "stony layer near Bridgeton."⁵

This quartzite, which may easily be recognized by its sugary texture, light buff or white color and by the frequent presence of fossils, was apparently much sought after by the Indians of southern New Jersey who used it in the manufacture of projectile points. The stone is known to local archaeologists as "Cohansey Quartzite";⁶ but the use of this name is unfortunate since it can easily be confused with that of the Cohansey formation which overlies the Kirkwood.

The quarrying of this stone was not restricted to aboriginal days, for not many years ago there was a quarry in it near Greenwich Pier, and there is a house in Bridgeton built almost entirely of "Cohansey Quartzite." Although most of these quarries are completely depleted, highly fossiliferous slabs of this rock can still be seen at Fairton, N. J.⁷ (See Figures 2, 3.)

The Kirkwood extends northeasterly across New Jersey, frequently outcropping, although more frequently overlain by the Cohansey sands or one of the Pleistocene formations (see Figure 1). Although the outcrops which contain invertebrate fossils are for the most part limited to Salem and Cumberland counties, there are a few records of Kirkwood fossils farther north along the strike of the formation.

W. B. Clark⁸ speaks of a few fossils at Farmingdale, Monmouth County and a small Miocene vertebrate fauna was collected many years ago near Squankum, in the same county, where the Kirkwood overlies the Shark River (Eocene) formation.⁹ In addition, characteristic Miocene diatoms are known from clay pits at Whitesville, near Asbury Park. That a fossiliferous phase of the Kirkwood does crop out elsewhere in Monmouth County

⁵ R. P. Whitfield, *Mollusca and Crustacea of the Miocene Formations of New Jersey*. U. S. Geol. Surv., Mon. 24, 1894.

⁶ H. G. Richards, *Petrology of the Chipped Artifacts of the State of Delaware*. Bull. Arch. Soc. of Del., vol. 3, no. 4, pp. 5-9, 1941.

⁷ H. G. Richards, *A New Miocene Locality in New Jersey*. Amer. Mid. Nat., vol. 16, pp. 208-209, 1935.

⁸ W. B. Clark, *Ann. Rept. of N. J. State Geol. for 1892*, pp. 212-213.

⁹ O. C. Marsh, *Description of Miocene Mammalia*. Amer. Jour. Sci., ser. 3, vol. 46, pp. 407-412, 1893.

H. E. Wood, *Lower Miocene Land Mammals of New Jersey*. Bull. Geol. Soc. Amer., vol. 50, pp. 1968-1969, 1939.

is suggested by the occasional finding on the ocean beach of fossils, possibly of Miocene age; such specimens have been found at Shark River (Belmar) and Asbury Park. Furthermore, Lea¹⁰ described two Miocene mollusks, *Acteocina wetherilli* and *Mastra clathrodon*, and stated that they were reported to have come from Deal, N. J., although he was not positive of the record. The proximity of Deal to the Miocene diatomaceous outcrops at Whitesville is, in our opinion, significant.

It is possible that the outcrop may be beneath the sea and that the fossils are washed onto the beaches after storms as in the case of Pliocene and Pleistocene fossils along the coast of North Carolina.

Well borings along the coast, particularly between Atlantic City and Cape May, have demonstrated a great thickness of Miocene deposits—to 1000 feet thick. Although these well samples have been studied by Woolman,¹¹ and it was recognized that at least part of their fauna correlated with the St. Mary's formation of Maryland (highest of the Miocene Chesapeake Group of Maryland) no detailed analysis of the fauna has heretofore been published. In as much as fossils from additional wells have been made available in recent years and since much of Woolman's material has been subjected to further study, a brief discussion of the sub-surface Miocene stratigraphy will be attempted in a later section of this report.

Cohansey Formation

The Cohansey sand which overlies the Kirkwood in many places, is composed chiefly of quartz sand with occasional lenses of clay or gravel. It forms the surface of a large area of the Coastal Plain of New Jersey. No definite invertebrate or vertebrate fossils have been found in any of the exposures, although a few plant remains reported by Hollick¹² near Bridgeton, indicate a flora comparable with certain upper Miocene localities of Europe.

According to Lewis and Kummel¹³ "inasmuch as sands similar to the Cohansey are revealed in borings along the coast and there overlie clays carrying Miocene fossils characteristic of the St. Mary's, the highest division of the Chesapeake group, the Cohansey apparently belongs to a still later phase of the Miocene, or perhaps even to the Pliocene. It is possible however, that as now defined, it may represent, in part at least, the shore-

¹⁰ Isaac Lea, Contributions to Geology, p. 213, 1833.

¹¹ Lewis Woolman, See brief papers in the various Reports of the New Jersey State Geologist between 1889 and 1902.

¹² Arthur Hollick, Paleobotany of the Yellow Gravel at Bridgeton, New Jersey. Torrey Bot. Club Bull., vol. 19, pp. 330-333, 1892; New Species of Leguminous pods from the Yellow Gravel at Bridgeton, New Jersey. Torrey Bot. Club Bull., vol. 23, pp. 46-49, 1896; A new fossil Monocotyledon from the Yellow Gravel at Bridgeton, N. J. Torrey Bot. Club Bull., vol. 24, pp. 329-331, 1897.

¹³ Lewis and Kummel, 1916, op. cit., p. 72.

ward facies of the fossiliferous Miocene clays found in the borings along the coast, and that it should be correlated with the Choptank and St. Mary's of Maryland. In the light of all data at present available, however, the former view seems the more probable."

PREVIOUS WORK ON MIOCENE INVERTEBRATE FOSSILS

Although Conrad, Gabb and others described species from the "Shiloh Marl" in various papers published as early as 1834, no attempt at a list of the fauna was made until 1864 when Meek¹⁴ listed 15 species of mollusks and two bryozoa. This list was quoted by Cook¹⁵ in his report on the Geology of New Jersey in 1868.

In 1886 and 1887 Heilprin¹⁶ discussed the Miocene fauna of New Jersey and added numerous species to the list. In the later paper he listed 82 species from the Miocene of the state including three new species and a variety. Subsequent work has shown certain of these identifications to be erroneous and a few specimens can not be verified since there is no material available from New Jersey in any collection examined.

Woolman¹⁷ listed Miocene mollusks from numerous wells in southern New Jersey, mostly along the coast between Atlantic City and Cape May. Many of the specimens listed by him are in the collections of the Academy of Natural Sciences of Philadelphia or the New Jersey State Museum. Other species are recorded by Woolman which can not be verified by the actual specimens. These are omitted from the systematic section because it is highly probable that some of these are misidentifications of species herein discussed under another name.

The only thorough study of the Miocene fauna of New Jersey is that of Whitfield in 1894¹⁸ who reviewed all previous work and listed a total of 102 species of mollusks, one brachiopod and one barnacle. All of his species were figured, and though the present writers can not agree with all of Whitfield's determinations, his report has been of great value in the preparation of this paper.

Dall¹⁹ revised certain of Whitfield's determinations and described sev-

¹⁴ F. B. Meek, Check List of the Invertebrate Fossils of North America—Miocene. Smith Misc. Coll., vol. 7, art. 7, 1864.

¹⁵ George H. Cook, The Geology of New Jersey, p. 297, 1868.

¹⁶ Angelo Heilprin: On Miocene Fossils from Southern New Jersey. Proc. Acad. Nat. Sci. Phila., vol. 38, p. 351, 1886. The Miocene Mollusca of the State of New Jersey. Proc. Acad. Nat. Sci. Phila., vol. 39, pp. 397-405, 1887.

¹⁷ Lewis Woolman, Various reports in Annual Reports of N. J. State Geologist between 1889 and 1902

¹⁸ Robert P. Whitfield, Mollusca and Crustacea of the Miocene Formations of New Jersey. U. S. Geol. Surv., Mon. 24, 1894.

¹⁹ William H. Dall, Contributions to the Tertiary Fauna of Florida. Trans. Wagner Free Inst. Sci., vol. 3, pt. 1-6, 1890-1903.

eral new species. In discussing the fauna he remarked (page 1593) that the deposits at Shiloh and Jericho represented a mechanical mixture of fossils due to violent currents, and that it was impossible to say whether two or more epochs were represented in the fauna of the marls.

Glenn and Martin²⁰ in discussing the Miocene fauna of Maryland, gave occasional references to New Jersey records. The Shiloh fauna was apparently regarded as equivalent to the Calvert formation.

Probably because of the fact that most of the fossil localities were marl pits which were filled with water or otherwise not accessible because of disuse, little more was done with the Miocene fauna of New Jersey until 1931 when Pilsbry²¹ revised the barnacles of the Shiloh deposit. Two years later Pilsbry and Harbison²² reviewed the Cancellariidae, Turridae and Columbelloidae and described 17 new miscellaneous species from Shiloh and from a well at Sea Isle City. In commenting upon the origin of the deposit, they disagreed with Dall's contention that the fauna has been mechanically mixed. According to Pilsbry and Harbison, "the rarity of rolled and worn shells, the sharp edges of most broken shells and the perfection of barnacle plates which are more friable than molluscan shells, as well as the fine grain of the sediment are arguments against the hypothesis of such a mixture. It has the appearance of a deposit in reasonably quiet water of only a few fathoms depth."

In 1935, Richards²³ in a brief paper called attention to mollusks in the sandstone at Fairton.

MIocene FOSSIL LOCALITIES IN NEW JERSEY

1. *Shiloh*. By far the majority of the Miocene fossils from New Jersey are labelled Shiloh. During the last century, when the marl industry was flourishing, there were numerous pits in this vicinity and fossils could easily be obtained from these diggings. According to Cook²⁴ the material came especially from the tributaries of Stow Creek. None of these pits are accessible at the present time except the Ayres Pits, which were reopened some 20 years ago by the present owner, Mr. Shephard. Although it has not been worked for a number of years, diggings from the pit contain a fairly representative set of Miocene fossils. The species most abundant in excavations from this pit are as follows:

²⁰ G. C. Martin, L. C. Glenn, et al., *The Miocene Deposits of Maryland*. Maryland Geol. Surv., 1904.

²¹ H. A. Pilsbry, Cirripedia (Balanus) from the Miocene of New Jersey. *Proc. Acad. Nat. Sci. Phila.*, vol. 82, pp. 429-433, 1931.

²² H. A. Pilsbry and Anne Harbison, Notes on the Miocene of Southern New Jersey. *Proc. Acad. Nat. Sci. Phila.*, vol. 85, pp. 107-120, 1933.

²³ H. G. Richards, A New Miocene Locality in New Jersey. *Amer. Mid. Nat.*, vol. 16, pp. 208-209, 1935.

²⁴ George H. Cook, 1868, *op. cit.*, pp. 296-298.

<i>Astarte distans</i> Conrad	<i>Turritella cumberlandia</i> Conrad
<i>Eucrassatella melina</i> (Conrad)	<i>Mitrella communis mediocris</i> Pilsbry
<i>Phacoides crenulatus</i> (Conrad)	& Harbison
<i>Saxicava artica bilineata</i> Conrad	<i>Crucibulum costatum</i> (Say)
<i>Corbula elevata</i> Conrad	<i>Crepidulum plana</i> Say
<i>Cancellaria alternata</i> Conrad	<i>Natica hemicrypta</i> (Gabb)
<i>Turritella plebia</i> Say	<i>Discinisca lugubris</i> (Conrad)
<i>Turritella aequistriata</i> Conrad	

2. *Jericho*. Similar marl pits were dug near the town of Jericho. None are productive at the present time, although a few fossils were found at the former "Elwell Pits," on Bishop Run, south of Jericho.

3. *Bridgeton*. Whitfield frequently speaks of a "stony layer" near Bridgeton and many of the fossils in the various museums labelled "Bridgeton" are in the sandstone phase of the Kirkwood. The exact locality of the fossils was not given and no exposures can be found in the vicinity of Bridgeton today.

4. *Fairton*. Large slabs of fossiliferous sandstone and quartzite were dredged from the bottom and right bank of Mill Creek, a branch of Cohansey Creek, at the highway bridge in the town of Fairton. At the present writing numerous slabs can be seen along the stream bank.²⁵ (Figs. 2, 3.)

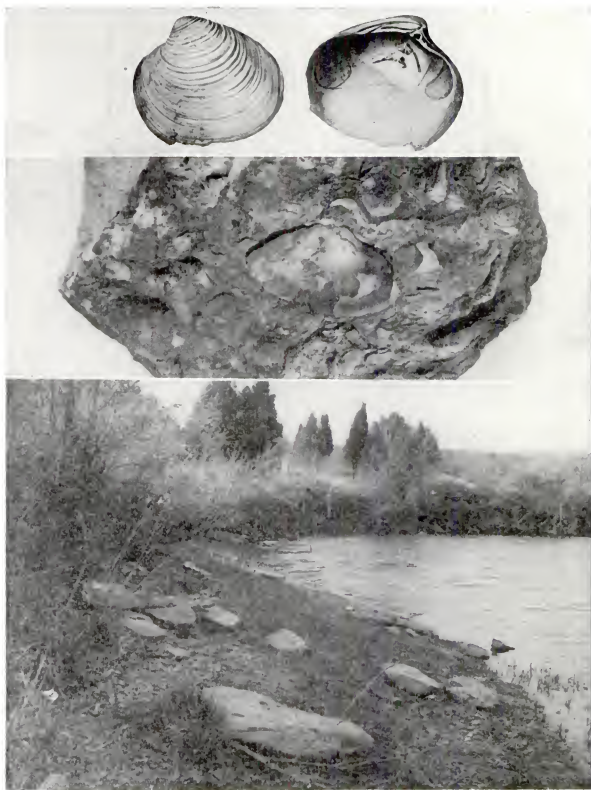
5. *Greenwich*. According to local residents there was an extensive quarry of the "Cohansey Quartzite" near Greenwich Pier, but at the present time it has been depleted. Merely a few fragments of fossiliferous quartzite can now be seen scattered in the marsh near Cohansey Creek.

6. *Quinton*. Shells were obtained from a well between the surface and the depth of 30 feet.

7. *Dividing Creek*. Fossil shells were found between the depths of 150 and 170 feet in the Miocene section of a well at the school house in the town of Dividing Creek. Unfortunately, we have been unable to locate the specimens, and so can merely record the well as a probable Miocene locality.

8. *Millville*. A large collection of fossils was obtained from a well on the Steelman Farm near Millville, N. J. The collection is at present in the United States National Museum, Washington, D. C., where it was presented by Dr. Hildegard Van Hagen, of Atlantic City, N. J. A few duplicate shells as well as samples at the various levels are in the collections of the New Jersey Geological Survey in Trenton, N. J. The majority of the shells occurred between the depths of 212 and 580 feet. All are apparently Miocene, although the exact correlation is uncertain. The base of the Miocene and the top of the Vincentown (Eocene) is thought to occur

²⁵ H. G. Richards, 1935, op. cit., p. 209.



FIGS. 2, 3, 4.—FIG. 2 (below). Fossil exposure, Cohansey Creek, Fairton, N.J.
FIG. 3 (middle). *Eucrassatella melina* (Conrad), in "Cohansey Quartzite," Fairton,
N. J. FIG. 4 (above). *Clementia inoceriformis* (Wagner). Full shells from Porto Bello,
Md., attached hinges from Shiloh, N. J. A.N.S.P. 4303.

at 580 feet. A few additional shells were obtained from wells of the Millville Water Company, between 212 and 255 feet.

9. *Glassboro*. Woolman recorded Miocene fossils between 80 and 145 feet in a well. These samples were missing from the Woolman Collection at the Academy.

10. *Farmingdale*. W. B. Clark recorded specimens of *Crassatella* (= *Eucrassatella melina*?) from the contact between the Miocene and the underlying Eocene at the gravel pits near Farmingdale Station.

11. *Asbury Park*. Woolman recorded characteristic Miocene diatoms from clay pits at Whitesville, northwest of Asbury Park. Lea described *Acteocina wetherilli* and *Mactra clathrodon* from Deal, although he was not sure of the exact locality. It is possible that these two represent the same or nearby localities.

As indicated elsewhere in this report, fossils of possible Miocene age are occasionally washed onto the beach between Belmar and Asbury Park. The United States National Museum has some specimens of *Mactra clathrodon* Lea, picked up by Whitfield from the beach at Shark River (Belmar) (U.S.N.M. 153741).

12. *Brigantine*. A single young specimen of *Solarium trilineata* Conrad, and unidentifiable fragments were taken from the well at Brigantine between the depths of 625 and 651 feet.

13. *Atlantic City*. The collections of the Academy contain numerous fossils obtained by Woolman from wells in Atlantic City, but no depth is given. Many of these specimens were figured by Whitfield. A restudy of many of Woolman's original well borings has yielded numerous Miocene fossils between the depths of 400 and 1240 feet. The base of the Miocene is thought to occur at 1240 feet; Eocene foraminifera were found at the depth of 1430-1450 feet.

14. *Ocean City*. Shells were obtained between the depths of 385 and 730 feet in the Woolman borings from Ocean City.

15. *Sea Isle City*. The Woolman Collection contains Miocene fossils between the depths of 490 and 863 feet from a Sea Isle City well. More recently, in 1932, Mr. William Tullner, Jr., obtained a large collection of fossils between the depths of 600 and 700 feet. Many of these were discussed by Pilsbry and Harbison in the paper cited above.

16. *Cape May Court House*. Shells were obtained from a drilled well near the Railroad Station at the depth of 520 feet. These are in the collection of the Historical Museum in Cape May Court House, and were examined through the courtesy of Mr. Edward Post, Custodian.

17. *Avalon*. The Woolman Collection yielded Miocene fossils between the depths of 375 and 815 feet in an Avalon well. Unfortunately, the best collection of shells had no data as to depth.

18. *Wildwood*. The Woolman Collection contains fossils obtained at various levels between 411 and 1000 feet.

19. *Cape May*. Shells were obtained from various depths between 420 and 1140 feet in several wells at Cape May and Cape May Point. A characteristic species of the upper level (420-460) feet is *Bulliopsis integra*, a characteristic St. Mary's species.*

EXPLANATION OF SYSTEMATIC DISCUSSION OF FOSSILS

The systematic section of this report discusses all the species of invertebrates from the Miocene formations of New Jersey which are known at the present time. In all cases the original material of Whitfield, Conrad, etc., as well as more recent collections, has been studied and illustrations have been prepared for each species.

Although no attempt has been made to prepare a complete synonymy, the reference to the original description as well as other important references pertaining to distribution in New Jersey or nearby States, are herein recorded.

For the sake of convenience, all Miocene fossil localities in New Jersey, whether in outcrops or from wells, are regarded as part of the Kirkwood formation, although later work may suggest the subdivision of the subsurface Kirkwood into several phases. (See discussion at end of this paper.)

Since there is a close similarity between the fauna of the Kirkwood of New Jersey and the faunas of the Miocene formations of Maryland, the range of each Kirkwood species in the Calvert, Choptank and St. Mary's of Maryland is recorded, the data largely being taken from the report of the Maryland Geological Survey.²⁶ Records from Virginia and North Carolina are based upon reports of the Virginia and North Carolina Geological Surveys²⁷ as well as material recently collected by the senior author. Since a report on the Miocene formations of Virginia and North Carolina by Dr. Julia Gardner is now awaiting publication by United States Geological Survey, no attempt will be made in this paper to record the exact horizons south of Maryland where the New Jersey species have been found, although the general geographic range is indicated whenever possible. Furthermore, the geological range of each species is given in most cases. In addition to being discussed under the different species, these data are summarized in Table 1.

* As this paper was going to press, fossils were obtained from a well at Landisville, Atlantic County, N. J., between the depths of 405 and 470 feet. The following were recognized: *Pecten madisonius* Say, *Corbula* sp., *Astarte distans* Conrad, and *Ensis directus* Conrad.

²⁶ G. B. Shattuck, et al., Maryland Geol. Surv., Miocene, 1904.

²⁷ W. B. Clark and B. L. Miller, Virginia Geol. Surv., Bull. 4, 1912. W. B. Clark and B. L. Miller, North Carolina Geol. and Econ. Surv., vol. 3, 1912.

The collections where each species may be found are also indicated. However, only specimens from the Miocene of New Jersey are included. The following abbreviations are used throughout the report:

- A.M.N.H. American Museum of Natural History, New York, N. Y.
 A.N.S.P. Academy of Natural Sciences of Philadelphia, Philadelphia, Pa.
 C.M.C.H. Historical Museum, Cape May Court House, N. J.
 N.J.S.M. New Jersey State Museum, Trenton, N. J.
 Newk. Newark Museum, Newark, N. J.
 Rutg. Rutgers University, New Brunswick, N. J.
 U.S.N.M. United States National Museum, Washington, D. C.
 W.F.I.S. Wagner Free Institute of Science, Philadelphia, Pa.

It should be further pointed out that no attempt has been made in this paper to make any revision of the various genera. In fact, in many cases the generic names are used in a rather broad sense and thus it may appear that we are reverting to earlier work instead of taking advantage of the recent studies in the classification of the various families and genera. While we agree that such studies are exceedingly valuable, it does not appear necessary in a paper of this kind to discuss the various subgenera and other smaller divisions of classification. On the other hand, an attempt has been made to bring the literature up to date and to correct any generic or specific names used in previous literature that have since been shown to be preoccupied or otherwise erroneous.

COELENTERATA

Astrangia danae Agassiz

Plate 22, figs. 2, 3.

Astrangia danae Agassiz, Proc. Amer. Ass. Adv. Sci., vol. 2, p. 68, 1849.

Not common.

KIRKWOOD: Shiloh, Millville (depth?), Sea Isle City (600-700 feet).

Miocene Distribution.—?

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; A.M.N.H.

Two other species of corals have been reported from the Miocene of New Jersey, but since no specimens are available, their presence can not be confirmed.

Astrangia marylandica (Conrad)

Reported by Pilsbry and Harbison from the Sea Isle City well from between the depths of 600 and 700 feet. This species is reported from the St. Mary's formation of Maryland as well as the Miocene of Virginia, North and South Carolina, and Florida, as well as the Pliocene and Pleistocene (?) of North Carolina.

Flabellum cuneiformis Lonsdale var. **wailesi** Conrad

Reported by Woolman in the Report of the New Jersey State Geologist for 1901 as provisionally identified by Dr. T. Wayland Vaughan. It came from the Atlantic City well (depth 1012 feet) and the Wildwood well (depth 1200 feet).

BRYOZOA

Acanthodesia savarti (Savigni-Audouin)

Plate 22, fig. 1.

Flustra savarti Savigni, Description de l'Egypte, pl. 10, fig. 10, 1812; Audouin, Explication sommaire des planches de Polypes de l'Egypte et de la Syrie, p. 240, 1826.

Acanthodesia savarti Canu and Bassler, U. S. Nat. Mus., Bull. 125, pp. 31-33, pl. 11, figs. 1-9, 1923.

Colonies of bryozoa were noted on shells of *Terebra whitfieldi* Martin and *Muricidea millvillensis* Richards and Harbison. Some specimens were identified by Dr. R. S. Bassler as one of the forms of *A. savarti*.

KIRKWOOD: Millville (305, 460, 505 feet).

Miocene Distribution.—Maryland, Virginia; various forms common throughout Miocene of Europe and America.

Geological Range.—Miocene—Recent.

Collections.—U.S.N.M.

Other poorly preserved specimens of Bryozoa were obtained from Shiloh and Fairton.

ECHINODERMATA

Echinarachnius sp.

Plate 22, figs. 4, 5.

Fragments of a Sand Dollar resembling the Pleistocene and Recent *E. parma* Leske were found in the well samples from Cape May Court House.

KIRKWOOD: Cape May Court House (520 feet).

Collections.—A.N.S.P.; C.M.C.H.

BRACHIOPODA

Discinisca lugubris (Conrad)

Plate 17, fig. 12.

Capulus lugubris Conrad, Jour. Acad. Nat. Sci. Phila., vol. 7, p. 143, 1834.

Discina lugubris Whitfield, U. S. Geol. Surv., Mon. 24, p. 23, pl. 1, figs. 1-3, 1894.

Discinisca lugubris Martin, Maryland Geol. Surv., Miocene, p. 402, pl. 109, figs. 1-3, 1904.

Fairly common.

KIRKWOOD: Shiloh, Bridgeton, Atlantic City (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia, North Carolina, South Carolina.

Geological Range.—Miocene—Pliocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; A.M.N.H.; Rutg.; Newk.

MOLLUSCA

PELECYPODA

***Nucula proxima* Say**

Plate 7, fig. 1.

Nucula obliqua Say, Amer. Jour. Sci., vol. 2, p. 40, 1820 (not of Lamarck 1819).*Nucula proxima* Say, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 270, 1822; Whitfield, U. S. Geol. Surv., Mon. 24, p. 50, pl. 7, figs. 7-10, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 398, pl. 108, figs. 5, 6, 1904.

Fairly common.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Millville (depth?), Atlantic City (depth?), Ocean City (730 feet), Sea Isle City (600-700 feet), Wildwood (887-930, 920-1000 feet), Cape May (980 feet).**Miocene Distribution.**—Maryland (CALVERT, CHOPTANK), Virginia, North Carolina, South Carolina.**Geological Range.**—Miocene—Recent.**Collections.**—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.***Nucula sinaria* Dall**

Plate 7, fig. 2.

Nucula sinaria Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, p. 575, pl. 32, fig. 7, 1904; Glenn, Maryland Geol. Surv., Miocene, p. 399, pl. 108, figs. 7, 8, 1904.

Known from New Jersey by a single specimen only.

KIRKWOOD: Shiloh.**Miocene Distribution.**—Maryland (CHOPTANK, St. MARY's), Florida.**Geological Range.**—Miocene.**Collections.**—W.F.I.S.***Leda liciata* (Conrad)**

Plate 7, fig. 3.

Nucula liciata Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 305, 1843.*Leda liciata* Glenn, Maryland Geol. Surv., Miocene, p. 395, pl. 107, figs. 5-8, 1904.

Rare.

KIRKWOOD: Shiloh, Cape May (980 feet).**Miocene Distribution.**—Maryland (CALVERT, CHOPTANK).**Geological Range.**—Miocene.**Collections.**—A.N.S.P.***Leda liciata amydra* Dall**

Plate 7, fig. 4.

Leda amydra Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, pp. 591, 592, 1898.*Leda liciata amydra* Glenn, Maryland Geol. Surv., Miocene, p. 396, pl. 107, figs. 9-10, 1904.Glenn has shown that this is merely the smooth, polished form of *L. liciata* Conrad.**KIRKWOOD:** Shiloh.**Miocene Distribution.**—Maryland (CALVERT).**Geological Range.**—Miocene.**Collections.**—A.N.S.P.

***Yoldia laevis* (Say)**

Plate 7, figs. 5, 6.

Nucula laevis Say, Jour. Acad. Nat. Sci. Phila., vol. 4, p. 141, pl. 10, fig. 5, 1824.*Yoldia limatula* Whitfield, U. S. Geol. Surv., Mon. 24, p. 51, pl. 7, figs. 11-12, 1894 (not of Say 1831).*Yoldia laevis* Glenn, Maryland Geol. Surv., Miocene, p. 397, pl. 108, figs. 3, 4, 1904.

Fairly common. This species is apparently the ancestor of the Pleistocene and Recent *Y. limatula* Say with which it has frequently been confused.

KIRKWOOD: Shiloh, Jericho, Fairton.

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S?), Virginia, Georgia.

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; Rutg.

***Arca subrostrata* Conrad**

Plate 7, fig. 13; pl. 14, figs. 5, 6.

Arca subrostrata Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 30, 1841.*Scapharca subrostrata* Whitfield, U. S. Geol. Surv., Mon. 24, p. 45, pl. 6, figs. 11-13, 1894.*Arca subrostrata* Glenn, Maryland Geol. Surv., Miocene, p. 385, pl. 104, fig. 3, 1904.

Two small fragments were obtained from a well in Atlantic City which Whitfield referred to this species. No other specimens are known from New Jersey.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P.

? *Arca staminea* Say

Plate 7, fig. 14.

Arca staminea Say, Amer. Conch., pl. 36, fig. 2, 1832.*Arca callipleura* Conrad, Foss. Med. Tert., p. 54, pl. 29, fig. 2, 1840; Whitfield, U. S. Geol. Surv., Mon. 24, p. 43, pl. 6, figs. 8, 9, 1894.*Arca staminea* Glenn, Maryland Geol. Surv., Miocene, p. 387, pl. 105, figs. 2-6, 1904.

Known from New Jersey only by a fragment from the Atlantic City well which Whitfield identified as this species. The fragments are too small for positive identification. According to Glenn, *A. callipleura* is merely a short, elevated, thickened and well sculptured form of *A. staminea*.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—Maryland (CHOPTANK), Virginia (YORKTOWN).

Geological Range.—Miocene.

Collections.—A.N.S.P.

? *Arca lienosa* Say

Plate 14, figs. 3, 4.

Arca lienosa Say, Amer. Conch., pl. 36, 1832; Whitfield, U. S. Geol. Surv., Mon. 24, p. 44, pl. 6, figs. 10, 10a, 1894.

Several fragments from the Atlantic City well were questionably referred to this species by Whitfield.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—Virginia (YORKTOWN), North Carolina.

Geological Range.—Miocene—Pliocene.

Collections.—A.N.S.P.

? *Arca idonea* Conrad

Plate 14, fig. 2.

Arca idonea Conrad, Fossil Shells of the Tertiary, p. 16, pl. 1, fig. 5, 1832; Whitfield, U. S. Geol. Surv., Mon. 24, p. 47, pl. 7, fig. 1, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 389, pl. 106, figs. 1, 2, 1904.

Two small fragments are questionably referred to this species.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—Maryland (St. Mary's), Virginia.

Geological Range.—Miocene.

Collections.—A.N.S.P.

***Arca centenaria* Say**

Plate 7, figs. 7, 8.

Arca centenaria Say, Jour. Acad. Nat. Sci. Phila., vol. 4, p. 138, pl. 10, fig. 2, 1824; Whitfield, U. S. Geol. Surv., Mon. 24, p. 42, pl. 6, figs. 5-7, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 391, pl. 106, figs. 5, 6, 1904.

A common species at Shiloh. The New Jersey specimens are usually smaller than those from Virginia and farther south.

KIRKWOOD: Shiloh, Jericho, Bridgeton.

Miocene Distribution. — Maryland (CALVERT, CHOPTANK), Virginia, North Carolina, South Carolina.

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; Rutg.; Newk.

***Arca marylandica* (Conrad)**

Plate 7, figs. 9, 10.

Byssarca marylandica Conrad, Foss. Med. Tert., p. 54, pl. 29, fig. 1, 1840.

Barbatia marylandica Whitfield, U. S. Geol. Surv., Mon. 24, p. 48, pl. 7, figs. 2-4, 1894.

Arca marylandica Glenn, Maryland Geol. Surv., Miocene, p. 392, pl. 106, fig. 7, 1904.

Rare.

KIRKWOOD: Shiloh.

Miocene Distribution.—Maryland (CALVERT), Florida.

Geological Range.—Miocene.

Collections.—N.J.S.M.; U.S.N.M.; W.F.I.S.

***Arca millvillensis* new species**

Plate 7, figs. 11, 12.

The type and unique specimen is a left valve. Shell medium, moderately heavy, approximately ovate trigonal in outline. Umbone broad, rounded and elevated well above the hinge line. Anterior area rounding smoothly into the medial. Posterior area obliquely flattened and delimited by a subacute keel which extends from the umbone to the outer margin; dorsal margin approximately the greatest width of the shell. Sides approximately at right angles to the dorsal margin although the left side is somewhat more curved. Approximately 33 ribs, of which 8 are on the "shelf" directly in front of the keel. Sculptured with moderately conspicuous nodules which are much less distinct near the beak and on the "shelf." The inner margin is sharply fluted in harmony with the ribs. Teeth arranged in two series which meet with a barely perceptible interruption directly behind the umbone (as in *A. waltonia* Gardner). Adductor scars only moderately distinct and approximately the same as in *A. waltonia*. The pallial line is indistinct.

Dimensions.—Height 14.5 mm., width 17.0 mm.

TYPE.—U.S.N.M. 498976.

This species is apparently very close to *Arca (Diluvarca) waltonia* Gardner²⁸ from the Shoal River formation of the Alum Bluff Group of Florida. The New Jersey specimen is somewhat worn and does not show all the characteristics. It differs mainly from *A. waltonia* by its lower beak and the greater number of ribs.

Arca millvillensis is a more narrow and more squarish shell than *A. waltonia* from the Shoal River of Florida. The ribs are more numerous by 3 or 4 and more closely spaced and medially grooved. The grooving is most noticeable upon the anterior half of the shell but even the posterior ribs are faintly bifid. In the Shoal River species, the posterior radials are entire and the grooving of the anterior radials is not evident until the shell is about 15 millimeters high. In the species from the Kirkwood, the bifurcation is initiated before the shell has reached a height of 10 millimeters.

It is also close to *Arca (Diluvarca) staminea* Say, but although the Maryland species offers a wide range of variation in outline, no specimens have been seen where the proportions equal those of *A. millvillensis*.

KIRKWOOD: Millville (580 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—U.S.N.M. (Type).

***Glycymeris parilis* (Conrad)**

Plate 7, figs. 16, 17.

Pectunculus parilis Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 306, 1843; Foss. Med. Tert., p. 64, pl. 36, fig. 2, 1845.

? *Axinea lentiformis* (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 49, pl. 7, figs. 5-6, 1894 (not of Conrad).

Glycymeris parilis Glenn, Maryland Geol. Surv., Miocene, p. 393, pl. 107, figs. 1-2, 1904; Schoonover, Bulls. Amer. Pal., vol. 25, no. 94 B, p. 15, pl. 1, figs. 1, 8, 1941.

Young individuals are not uncommon at Shiloh; larger shells were taken from the Sea Isle City and Millville wells. This species is exceedingly close to *G. americana* DeFrance from the Pleistocene and Recent of the South Atlantic Coast.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Millville (420 feet), Sea Isle City (600-700 feet), Avalon (depth?).

Miocene Distribution.—Maryland (CALVERT, ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M.

***Modiola inflata* (Tuomey and Holmes)**

Plate 7, fig. 15.

Mytilus inflatus Tuomey and Holmes, Pleiocene Foss. S. C., p. 33, pl. 14, fig. 3, 1857.

Modiola inflata Whitfield, U. S. Geol. Surv., Mon. 24, p. 39, pl. 6, figs. 3, 4, 1894.

Rare and not found by recent collectors. It is apparently closely related to *M. tulipa* Linné of the modern southern Atlantic coast.

²⁸ Julia Gardner, U. S. Geol. Surv., Prof. Paper 142 A, p. 32, pl. 6, fig. 36, 1926.

KIRKWOOD: Shiloh, Bridgeton.

Miocene Distribution.—South Carolina (?).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.

? *Mytilus incurvus* (Conrad)

Plate 7, fig. 18.

Myoconcha incurva Conrad, Foss. Med. Tert., p. 3 of cover of no. 1; p. 52, pl. 28, fig. 1, 1840.

Mytiloconcha incrassata (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 38, pl. 5, figs. 10, 11, 1894 (not of Conrad).

Mytilus incurvus Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, p. 789, 1898; Glenn, Maryland Geol. Surv., Miocene, p. 363, pl. 96, figs. 2-4, 1902.

Badly worn apical portions of various valves have been found, but no perfect specimens. Whitfield's identification of these specimens was questioned by Dall.

KIRKWOOD: Shiloh, Sea Isle City (600-700 feet), Cape May Court House (520 feet), Avalon (375 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK), South Carolina (?), Florida (?).

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M.; C.M.C.H.; Newk.

Lithophaga subalveata Conrad

Plate 8, fig. 5.

Lithophaga subalveata Conrad, Amer. Journ. Conch., vol. 2, p. 73, pl. 4, fig. 4, 1866; Whitfield, U. S. Geol. Surv., Mon. 24, p. 40, pl. 5, fig. 9, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 364, pl. 97, fig. 1, 1904.

Conrad described a single specimen penetrating the shell of *Ostrea percrassa* Conrad. Whitfield was not able to locate the specimen and copied Conrad's figure. Recently, while chipping some of the rock matrix of a *Cardium patuxentium* shell in the New Jersey State Museum, two specimens of *L. subalveata* were discovered. They are merely labelled "New Jersey." A broken shell from Shiloh is also in the collection of the Wagner Institute.

KIRKWOOD: Shiloh.

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; W.F.I.S.

Melina maxillata (Deshayes)

Plate 8, fig. 1.

Perna maxillata Lamarek, An. Sans Vert., vol. 6, 1, 142, (syn. excl.), 1819; ed. Deshayes, vol. 7, p. 78, 1836.

Perna torta Say, Amer. Jour. Sci., vol. 2, p. 38, 1820; Whitfield, U. S. Geol. Surv., Mon. 24, pl. 5, figs. 12-13, 1894.

Melina maxillata Glenn, Maryland Geol. Surv., Miocene, p. 383, pl. 102, fig. 3, pl. 103, fig. 1, 1904.

Abundant but rarely obtained perfect.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Atlantic City (800 feet), Sea Isle City (600-700 feet), Cape May Court House (520).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia.

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; C.M.C.H.; Rutg.; Newk.

***Plicatula densata* Conrad**

Plate 8, figs. 2, 3.

Plicatula densata Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 311, 1843; Whitfield, U. S. Geol. Surv., Mon. 24, p. 35, pl. 5, figs. 3-8, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 371, pl. 98, figs. 7-9, 1904.

Fairly common.

KIRKWOOD: Shiloh, Jericho.

Miocene Distribution.—Maryland (CALVERT), Virginia, North Carolina, Florida.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.

***Plicatula marginata* Say**

Plate 8, figs. 6, 7.

Plicatula marginata Say, Jour. Acad. Nat. Sci. Phila., vol. 4, pp. 136-137, pl. 9, fig. 4, 1824; Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, p. 764, 1898.

Much rarer than *P. densata* Conrad but occasionally associated with it.

KIRKWOOD: Shiloh.

Miocene Distribution.—Virginia, North Carolina, South Carolina.

Geological Range.—Miocene—Pliocene.

Collections.—W.F.I.S.

***Plicatula inornata* (Whitfield)**

Plate 8, figs. 8, 9.

Spondylus inornatus Whitfield, U. S. Geol. Surv., Mon. 24, p. 34, figs. 1, 2, 1894.

Known only from a single specimen and although described as a *Spondylus*, should probably be referred to the genus *Plicatula*. Gardner²⁹ placed it tentatively in the synonymy of *P. densata* Conrad.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—U.S.N.M.

***Pecten madisonius* Say**

Plate 8, fig. 11.

Pecten madisonius Say, Jour. Acad. Nat. Sci. Phila., vol. 4, p. 134, 1824; Whitfield, U. S. Geol. Surv., Mon. 24, p. 30, pl. 4, figs. 1-5; pl. 2, fig. 8, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 377, pl. 100, fig. 1, 1904.

Chlamys (Lyropecten) madisonius Schoonover, Bulls. Amer. Pal., vol. 25, no. 94 B, pp. 28-37, pl. 2, figs. 3, 5, 6, 1941.

²⁹ Julia Gardner, The Molluscan Fauna of the Alum Bluff Group of Florida. U. S. Geol. Surv., Prof. Paper 142-A, p. 51, 1926.

Known from the New Jersey Miocene only by small individuals and fragments of larger shells; very common. Miss Schoonover has recently discussed the varieties of this species from the Miocene of Maryland.

KIRKWOOD: Shiloh, Jericho, Sea Isle City (600-700 feet), Cape May Court House (520 feet), Avalon (810 feet), Wildwood (611-18, 718-32, 887-920, 930-1000 feet), Cape May (600-40 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK), Virginia.

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; Rutg.; Newk.

***Pecten humphreysii* Conrad**

Plate 8, fig. 4.

Pecten humphreysii Conrad, Proc. Nat. Inst., Bull. 2, p. 194, pl. 2, fig. 2, 1842.

Vola humphreysii Whitfield, U. S. Geol. Surv., Mon. 24, p. 32, pl. 4, figs. 6-9, 1894.

Pecten humphreysii Glenn, Maryland Geol. Surv., Miocene, p. 372, pl. 98, figs. 10-12, 1904.

A few of the New Jersey shells can be referred to typical *P. humphreysii*, although the majority belong to the variety *woolmani* Heilprin.

KIRKWOOD: Shiloh.

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—N.J.S.M.

***Pecten humphreysii woolmani* Heilprin**

Plate 8, figs. 12, 13; pl. 9, fig. 2.

Pecten humphreysii Conrad, Proc. Nat. Inst., Bull. 2, p. 194, pl. 2, fig. 2, 1842.

Vola humphreysii Whitfield, U. S. Geol. Surv., Mon. 24, p. 32, pl. 4, figs. 6-9, 1894.

Pecten humphreysii woolmani Heilprin, Proc. Acad. Nat. Sci. Phila., vol. 39, p. 405, 1887.

Heilprin regarded the New Jersey specimens of *P. humphreysii* as a distinct variety differing from the typical "in the greater elevation of the ears and the more distinct quadrangulation of the ribs of the convex valve." While all the New Jersey specimens are either juvenile or fragmentary, most of them fit Heilprin's designation.

KIRKWOOD: Shiloh, Jericho, Millville (depth?), Cape May (depth?).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 10373); N.J.S.M.; U.S.N.M.; W.F.I.S.; Newk.

? *Pecten eboreus* Conrad

Pecten eboreus Conrad, Amer. Jour. Sci., vol. 23, p. 341, 1833.

Pecten vicenarius Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 306, 1843; Whitfield, U. S. Geol. Surv., Mon. 24, p. 31, 1894.

Whitfield very tentatively referred a number of fragments of a small *Pecten* to this species. Also, one very poor specimen obtained from the Atlantic City well was identified by Woolman as *P. comparilis* Tuomey and Holmes (= *P. eboreus* Conrad). However, the specimen is so poorly

preserved that it is impossible to verify this identification. *P. eboreus* is more characteristic of the Miocene and Pliocene of North and South Carolina, and the New Jersey record must be regarded as questionable.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—Virginia, North Carolina, South Carolina, Florida.

Geological Range.—Miocene—Pliocene.

Collections.—A.N.S.P.

***Pecten gibbus* (Linné)**

Plate 17, fig. 3.

Ostrea gibba Linné, Syst. Nat., ed. 10, no. 172, p. 698, 1758.

Pecten gibbus Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, p. 745, 1898.

One almost perfect specimen and several fragments were found in the Millville well. This is the first record from the Miocene of New Jersey, although it is common in the Pleistocene. The Miocene specimens are of the typical *P. gibbus gibbus*.

KIRKWOOD: Millville (344 feet).

Miocene Distribution.—Virginia.

Geological Range.—Miocene to Recent.

Collections.—U.S.N.M.

***Anomia simplex* d'Orbigny**

Plate 8, fig. 10; pl. 17, fig. 4.

Anomia simplex d'Orbigny, Moll. Cubana, Spanish ed., 1845; vol. 2, p. 367, pl. 38, figs. 31-33, 1853.

Anomia ephippium var. Conrad, Foss. Med. Tert., p. 75, pl. 43, fig. 4, 1845.

Anomia ephippium Tuomey and Holmes, Pleiocene Foss. S. C., p. 18, pl. 5, fig. 4, 1855; Holmes, Post Pleiocene Foss. S. C., p. 11, pl. 2, fig. 1, 1858.

Anomia simplex Glenn, Maryland Geol. Surv., Miocene, p. 369, pl. 98, fig. 1, 1904.

Very rare from the Miocene of New Jersey although abundant in the Pleistocene and Recent of that State.

KIRKWOOD: Cape May Court House (520 feet).

Miocene Distribution.—Maryland (St. Mary's), Virginia, North Carolina.

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; C.M.C.H.

***Ostrea virginica* Gmelin**

Plate 9, fig. 4.

Ostrea virginiana of Lister and other non-binomial authors.

Ostrea virginica Gmelin, Syst. Nat., p. 3336, 1792.

Ostrea mauricensis Gabb, Jour. Acad. Nat. Sci. Phila., ser. 2, vol. 4, p. 376, pl. 67, fig. 26, 1860 (in part).

Ostrea virginiana (Gmelin), Whitfield, U. S. Geol. Surv., Mon. 24, p. 27, pl. 2, figs. 1-7, 1894.

Ostrea virginiana procyon Tuomey and Holmes, Pleiocene Foss. S. C., p. 20, pl. 5, figs. 6-9, 1855; Whitfield, U. S. Geol. Surv., Mon. 24, p. 28, pl. 1, figs. 4-6, 1894.

It is impossible to distinguish these Miocene oysters from the modern *O. virginica* of the East Coast. Variety *procyon* Tuomey and Holmes is the

elongate, more narrow variety of *O. virginica* which is usually regarded as an ecological form; it is common along the New Jersey coast today.

KIRKWOOD: Shiloh, Jericho, Fairton (?), Millville (depth?).

Miocene Distribution.—New Jersey.

Geological Range.—Miocene to Recent.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; Rutg.

***Ostrea percrassa* Conrad**

Plate 9, figs. 1, 3.

Ostrea percrassa Conrad, Foss. Med. Tert., p. 50, pl. 25, fig. 1, 1840; Whitfield, U. S. Geol. Surv., Mon. 24, p. 29, pl. 3, figs. 1-4, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 382, pl. 102, figs. 1, 2, 1904.

The largest specimen of this oyster is in the New Jersey State Museum and measures 10 inches in length.

KIRKWOOD: Shiloh, Jericho, Millville (depth?).

Miocene Distribution.—Maryland (CALVERT), Florida.

Geological Range.—Eocene (?) to Miocene.

Collections.—A.N.S.P. (Type 14024); N.J.S.M.; U.S.N.M.; W.F.I.S.; Newk.

***Astarte distans* Conrad**

Plate 10, figs. 1, 2.

Astarte distans Conrad, Proc. Acad. Nat. Sci. Phila., vol. 14, pp. 288, 578, 1862; Whitfield, U. S. Geol. Surv., Mon. 24, p. 53, pl. 7, figs. 13-17, 1894.

Abundant at Shiloh and an excellent index fossil for the Kirkwood. Its closest relatives are *A. thisphila* Glenn and *A. undulata* Conrad.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Atlantic City (555 feet), Ocean City (595 feet), Sea Isle City (600-700, 800-18 feet), Cape May Court House (520 feet), Wildwood (800-900 feet), Cape May (depth?).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 13967); N.J.S.M.; U.S.N.M.; W.F.I.S.; C.M.C.H.; A.M.N.H.; Rutg.

***Astarte thomasii* Conrad**

Plate 10, figs. 3, 4.

Astarte thomasii Conrad, Proc. Acad. Nat. Sci. Phila., vol. 7, p. 267, 1855; Whitfield, U. S. Geol. Surv., Mon. 24, p. 55, pl. 8, figs. 3-7, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 351, pl. 94, figs. 1-2, 1904.

Conrad recorded the species from Mullica Hill, N. J., but this was probably an error. There are specimens in the New Jersey State Museum from Shiloh and some in the Academy from Shiloh, Atlantic City and Ocean City.

KIRKWOOD: Shiloh, Atlantic City (depth?), Ocean City (515 feet).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 14462); N.J.S.M.; Rutg.

Astarte cuneiformis Conrad

Plate 10, figs. 9, 10.

Astarte cuneiformis Conrad, Foss. Med. Tert., p. 42, pl. 20, fig. 9, 1840; Whitfield, U. S. Geol. Surv., Mon. 24, p. 52, pl. 8, figs. 8-10, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 353, p. 93, figs. 4-6, 1904.

Whitfield recorded some fragments from the Atlantic City well which he referred to this species.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P.

Astarte symmetrica Conrad

Plate 10, figs. 5, 6.

Astarte symmetrica Conrad, Jour. Acad. Nat. Sci. Phila., vol. 7, p. 134, 1834; Whitfield, U. S. Geol. Surv., Mon. 24, p. 54, pl. 8, figs. 1-2, 1894.

Whitfield recorded one waterworn specimen from the Atlantic City well which is apparently this species. The shell in question can not be located nor are there any other records of the species in New Jersey.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—Maryland? (ST. MARY'S?), Virginia.

Geological Range.—Miocene.

Collections.—A.N.S.P.?

Astarte perplana Conrad

Plate 10, figs. 7, 8.

Astarte perplana Conrad, Foss. Med. Tert., p. 43, pl. 21, fig. 3, 1840; Glenn, Maryland Geol. Surv., Miocene, p. 356, pl. 94, figs. 10-11, 1904.

Known from New Jersey by only a single lot.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—Maryland (ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P.

Astarte sp.

Plate 12, figs. 9, 10.

Dione sayana (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 75 (not *Callocardia sayana* of Conrad).

The badly worn specimen identified by Whitfield as *Dione sayana* [= *Callocardia*] does not belong in this genus, but has the teeth characteristics of an *Astarte*.

KIRKWOOD: Atlantic City (depth?).

Collections.—A.N.S.P.

Crassinella profundorum Pilsbry and Harbison

Plate 17, figs. 13, 14.

Crassinella profundorum P. & H., Proc. Acad. Nat. Sci. Phila., vol. 85, p. 117, pl. 4, figs. 22, 23, 1933.

Type and paratype obtained by William W. Tullner, Jr., in 1931, from the Sea Isle City well.

KIRKWOOD: Ocean City (730 feet), Sea Isle City (600–700 feet), Avalon (depth?), Wildwood (411–4 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12557).

***Eucrassatella melina* (Conrad)**

Plate 10, figs. 14, 15.

Crassatella melina Conrad, Fossil Shells Tert. Form., p. 23, pl. 9, fig. 2, 1832; Whitfield, U. S. Geol. Surv., Mon. 24, p. 60, pl. 8, figs. 11–13, 1894.

Crassatellites melinus Glenn, Maryland Geol. Surv., Miocene, p. 346, pl. 92, figs. 1, 2, 1904.

One of the most common species at Shiloh and, although found in the Calvert of Maryland, it is much more typical of the Kirkwood.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Fairton, Quinton (28 feet), Atlantic City (depth?), Sea Isle City (600–700 feet), Cape May Court House (520 feet).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; C.M.C.H.; Rutg.; Newk.

***Cardita arata* (Conrad)**

Plate 10, figs. 11, 12.

Carditamera arata Conrad, Fossil Shells Tert. Form., p. 20, pl. 5, fig. 1, 1832; Whitfield, U. S. Geol. Surv., Mon. 24, p. 57, pl. 9, figs. 5, 6, 1894.

Closely related to and possibly identical with the Maryland *C. protracta* Conrad, although usually proportionally shorter and thicker.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Atlantic City (depth?), Wildwood (411–4 feet).

Miocene Distribution.—Virginia, North Carolina, South Carolina.³⁰

Geological Range.—Miocene—Pliocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; Newk.

***Cardita aculeata* (Conrad)**

Carditamera aculeata Conrad, Proc. Acad. Nat. Sci. Phila., vol. 14, p. 585, 1862; Whitfield U. S. Geol. Surv., Mon. 24, p. 58, pl. 9, figs. 7, 8, 1894.

Probably the young of *C. arata* Conrad and equally close to *C. protracta* Conrad.

KIRKWOOD: Shiloh.

Miocene Distribution.—Maryland (?).³¹

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 13979).

³⁰ Since *C. arata* (Conrad) and *C. protracta* Conrad have been confused in the literature, it is difficult to determine their distribution. It is probable that both occur between New Jersey and South Carolina.

³¹ Range probably similar to that of *C. arata* Conrad.

Venericardia granulata Say

Plate 11, figs. 1, 2.

Venericardia granulata Say, Jour. Acad. Nat. Sci. Phila., vol. 4, p. 142, pl. 12, fig. 1, 1824.*Cardita granulata* Whitfield, U. S. Geol. Surv., Mon. 24, p. 56, pl. 9, figs. 1-4, 1894.*Venericardia granulata* Glenn, Maryland Geol. Surv., Miocene, p. 344, pl. 91, figs. 7-10, 1904.

Rare, only known from the deeper sections of wells.

KIRKWOOD: Atlantic City (936-41 feet), Sea Isle City (800-18 feet), Avalon (810 feet), Wildwood (800-900, 920-1000 feet), Cape May (1140 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia, North Carolina, South Carolina, Florida.*Geological Range*.—Miocene—Pliocene.*Collections*.—A.N.S.P.; N.J.S.M.; Rutg.**Sportella whitfieldi** Dall

Plate 11, fig. 5.

Syndosmya (?) *nuculoides* (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 81, pl. 15, figs. 7-9, 1894 (not of Conrad).*Sportella whitfieldi* Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 5, p. 1128, 1900; Glenn, Maryland Geol. Surv., Miocene, p. 324, pl. 87, fig. 5, 1904; Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 119, pl. 5, fig. 7, 1933.

Rare and somewhat variable.

KIRKWOOD: Shiloh.

Miocene Distribution.—Maryland (CALVERT).*Geological Range*.—Miocene.*Collections*.—A.N.S.P.; U.S.N.M.; W.F.I.S.**Diplodonta shilohensis** Dall

Plate 11, figs. 3, 4.

Mysia parilis Conrad, Amer. Jour. Conch., vol. 2, p. 71, pl. 4, fig. 1, 1866 (not of Conrad 1860 and 1865); Whitfield, U. S. Geol. Surv., Mon. 24, p. 61, pl. 9, figs. 9-13, 1894.*Diplodonta shilohensis* Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 5, p. 1184, 1900; Glenn, Maryland Geol. Surv., Miocene, p. 335, pl. 89, figs. 7, 8, 1904.

Rare and not found by recent collectors.

KIRKWOOD: Shiloh, Bridgeton.

Miocene Distribution.—Maryland (CHOPTANK).*Geological Range*.—Miocene.*Collections*.—A.N.S.P. (Type 13971); U.S.N.M.**Diplodonta acclinis** (Conrad)

Plate 11, figs. 8, 9, 10.

Lucina acclinis Conrad, Fossil Shells Tert. Form., p. 21, pl. 6, fig. 2, 1832; Whitfield, U. S. Geol. Surv., Mon. 24, p. 62, pl. 10, figs. 5, 6, 1894.*Diplodonta acclinis* Glenn, Maryland Geol. Surv., Miocene, p. 334, pl. 89, fig. 6, 1904.

Known from New Jersey only by an imperfect valve.

KIRKWOOD: Shiloh.

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia, North Carolina.*Geological Range*.—Miocene—Pliocene.*Collections*.—U.S.N.M.

Phacoides anodonta (Say)

Plate 11, figs. 15, 16.

Lucina anodonta Say, Jour. Acad. Nat. Sci. Phila., vol. 4, p. 146, pl. 10, fig. 9, 1824.*Phacoides anodonta* Glenn, Maryland Geol. Surv., Miocene, p. 337, pl. 90, figs. 3, 4, 1904.

The only New Jersey records are those obtained by Mr. Tullner in 1931.

KIRKWOOD: Sea Isle City (600-700 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia, North Carolina.*Geological Range*.—Miocene—Pliocene.*Collections*.—A.N.S.P.**Phacoides prunus** Dall

Plate 11, figs. 13, 14.

Phacoides prunus Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 6, p. 1384, pl. 52, fig. 8, 1903; Glenn, Maryland Geol. Surv., Miocene, p. 340, pl. 90, fig. 13, 1904.

Obtained by Mr. Tullner in 1931.

KIRKWOOD: Sea Isle City (600-700 feet).

Miocene Distribution.—Maryland (CALVERT, ST. MARY'S), Virginia.*Geological Range*.—Miocene.*Collections*.—A.N.S.P.**Phacoides crenulatus** (Conrad)

Plate 11, figs. 11, 12.

Lucina crenulata Conrad, Foss. Med. Tert., p. 39, pl. 20, fig. 2, 1840.*Phacoides crenulata* Whitfield, U. S. Geol. Surv., Mon. 24, p. 63, pl. 10, figs. 7-15, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 340, pl. 90, figs. 10-12, 1904.

Fairly common.

KIRKWOOD: Shiloh, Jericho, Ocean City (595 feet), Avalon (810 feet), Cape May Court House (520 feet), Wildwood (718-32, 800-900 feet), Millville (215 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia, North Carolina, South Carolina, Florida.*Geological Range*.—Miocene.*Collections*.—A.N.S.P.; N.J.S.M.; W.F.I.S.; C.M.C.H.; Newk.; Rutg.**Phacoides trisulcata whitfieldi** Dall

Plate 11, figs. 6, 7.

Lucina trisulcata Conrad, Amer. Jour. Sci., vol. 41, p. 346, 1841 (in part).*Lucina trisulcata* Whitfield, U. S. Geol. Surv., Mon. 24, p. 64, pl. 10, figs. 1-4, 1894.*Phacoides trisulcata whitfieldi* Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 6, p. 1370, 1903.Dall referred the New Jersey specimen to variety *whitfieldi*. The species is rare in the Miocene of New Jersey and has not been found by recent collectors.

KIRKWOOD: Atlantic City (depth?), Ocean City (385 feet), Avalon (depth?), Wildwood (411-4, 840-60, 920-1000 feet), Cape May (depth?).

Miocene Distribution.—Florida.*Geological Range*.—Miocene—Pliocene(?).*Collections*.—A.N.S.P. (Type 14017).

Chama congregata Conrad

Plate 12, fig. 13.

Chama congregata Conrad, Amer. Jour. Sci., vol. 23, p. 341, 1833; Whitfield, U. S. Geol. Surv., Mon. 24, p. 65, pl. 9, figs. 14-18, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 342, pl. 91, figs. 1-3, 1904.

A very common species at the Shephard pits.

KIRKWOOD: Shiloh, Jericho.

Miocene Distribution.—Maryland (CALVERT), Virginia, North Carolina, South Carolina, Florida (?).

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; Rutg.; Newk.

Cardium patuxentium Glenn

Plate 12, fig. 4.

Cardium craticuloides (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 66, pl. 10, figs. 16-19, 1894 (not of Conrad).

Cardium patuxentium Glenn, Maryland Geol. Surv., Miocene, p. 322, pl. 86, fig. 5, 1904.

According to Pilsbry and Harbison, Whitfield's specimens should be referred to this species instead of *C. craticuloides*. The species is rare in New Jersey and is most frequent in the form of casts in the stony phase of the formation near Bridgeton.

KIRKWOOD: Shiloh, Bridgeton, Fairton.

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; Newk.

Cardium laqueatum Conrad

Plate 12, fig. 6.

Cardium laqueatum Conrad, Jour. Acad. Nat. Sci. Phila., vol. 6, p. 258, 1831; Glenn, Maryland Geol. Surv., Miocene, p. 319, pl. 86, fig. 1, 1904.

A few fragments were obtained in the Sea Isle City well by Mr. Tullner. The species is more typical of Virginia.

KIRKWOOD: Sea Isle City (600-700 feet).

Miocene Distribution.—Maryland (CHOPTANK, ST. MARY'S), Virginia, North Carolina, South Carolina.

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.

Macrocallista marylandica (Conrad)

Plate 10, fig. 13.

Cytherea marylandica Conrad, Amer. Jour. Sci., vol. 23, p. 343, 1833.

Dione marylandica Whitfield, U. S. Geol. Surv., Mon. 24, p. 74, pl. 13, fig. 1, 1894.

Macrocallista marylandica Glenn, Maryland Geol. Surv., Miocene, p. 311, pl. 74, figs. 1, 2, 1904.

Known only from broken shells found in wells.

KIRKWOOD: Millville (410 feet), Atlantic City (well), Cape May Court House (520 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S?).

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M.; C.M.C.H.

Dosinia acetabulum (Conrad)

Plate 12, figs. 1, 5.

Artemis acetabulum Conrad, Fossils Shells Tert. Form., p. 20, pl. 6, fig. 1, 1832.*Dosinia acetabulum* Whitfield, U. S. Geol. Surv., Mon. 24, p. 73, pl. 13, fig. 1, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 315, pl. 83, fig. 1, pl. 84, fig. 1, 1904.

Known only by a few fragments from wells.

KIRKWOOD: Atlantic City (depth?), Wildwood (611-18 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia, Florida.*Geological Range*.—Miocene—Pliocene.*Collections*.—A.N.S.P.**Clementia inoceriformis** (Wagner)

Figure 4, p. 175.

Venus inoceriformis Wagner, Jour. Acad. Nat. Sci. Phila., vol. 8, p. 51, pl. 1, fig. 1, 1839.*Clementia inoceriformis* Glenn, Maryland Geol. Surv., Miocene, p. 315, pl. 82, figs. 1, 2, 1904.*Clementia (Egesta) inoceriformis* Woodring, U. S. Geol. Surv., Prof. Paper 147C, p. 38, pl. 15, figs. 5, 6, 1926.

The type of this species is from the St. Mary's formation at Portobello, Maryland. (A.N.S.P. 4033). Pasted on the inside of the type specimen is a piece of paper to which is attached the hinge of another specimen of this species. The paper is marked "Shiloh, N. J." If this label is correct, this specimen marks the northern limit of this genus.

KIRKWOOD: Shiloh.

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S).*Geological Range*.—Miocene.*Collections*.—A.N.S.P.**Antigona staminea** (Conrad)

Plate 12, figs. 7, 8.

Cytherea staminea Conrad, Foss. Med. Tert., p. 46, 1838; cover of no. 1, p. 3, pl. 21, fig. 1, 1839.*Venus (Artena) staminea* Whitfield, U. S. Geol. Surv., Mon. 24, p. 72, pl. 13, figs. 3-10, 1894.*Cytherea staminea* Glenn, Maryland Geol. Surv., Miocene, p. 314, pl. 76, figs. 6-8, 1904.*Antigona staminea* (Conrad), Palmer, Paleont. Amer., p. 329, pl. 27, figs. 2, 4, 5, 9, 10, 11, 14, 1927.

Rare and only represented by young specimens.

KIRKWOOD: Shiloh, Sea Isle City (768-85 feet), Cape May Court House (520 feet).

Miocene Distribution.—Maryland (CALVERT).*Geological Range*.—Miocene.*Collections*.—A.N.S.P.; U.S.N.M.; C.M.C.H.; A.M.N.H.**Venus ducatelli** Conrad

Plate 13, fig. 5.

Venus ducatelli Conrad, Foss. Med. Tert., p. 8, pl. 4, fig. 2, 1838.*Venus ducatelli* Whitfield, U. S. Geol. Surv., Mon. 24, p. 67, pl. 11, figs. 1-3, 1894.*Venus ducatelli* Glenn, Maryland Geol. Surv., Miocene, p. 304, pl. 75, figs. 7, 8, 1904.

Rare and usually broken.

KIRKWOOD: Shiloh, Jericho, Sea Isle City (600–700 feet).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 4140); N.J.S.M.; U.S.N.M.; W.F.I.S.

Venus mercenaria Linné

Plate 13, figs. 3, 4.

Venus mercenaria Linné, Syst. Nat., ed. 10, p. 686, 1758; Glenn, Maryland Geol. Surv., Miocene, p. 305, pl. 78, figs. 1, 2, 1904.

This is the common clam of recent shores. It is apparently rare in the Miocene of New Jersey, being represented only by a few broken specimens.

KIRKWOOD: Shiloh, Millville (212, 255 feet), Cape May Court House (520 feet), Wildwood (411–4, 611–8 feet), Cape May (411 feet).

Miocene Distribution.—Maryland (CALVERT, ST. MARY'S), Virginia.

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; W.F.I.S.; C.M.C.H.

Venus submercenaria Palmer

Plate 13, fig. 6; pl. 17, fig. 1.

Mercenaria cancellata Gabb, Jour. Acad. Nat. Sci. Phila., ser. 2, vol. 4, p. 376, pl. 67, fig. 25, 1860; Whitfield, U. S. Geol. Surv., Mon. 24, p. 68, pl. 12, figs. 2, 3, 1894 (not *Venus cancellata* Linné).

Venus mercenaria cancellata Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 6, p. 1311, 1903.

Venus submercenaria Palmer, Paleont. Amer., vol. 1, p. 394, pl. 32, fig. 1, 1927.

Apparently very rare and known only from the type specimen which is imperfect. Glenn placed Gabb's species in the synonymy of *V. mercenaria* Linné, but it is apparently, as pointed out by Mrs. Palmer, a distinct variety, easily recognized by its "numerous small angular ribs, crossed by fine, radiating, impressed lines" (Gabb). Dall stated that this variety is occasionally found in recent seas, although we have seen no such shells.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 4137).

Venus plena (Conrad)

Plate 13, figs. 1, 2.

Mercenaria plena Conrad, Amer. Jour. Conch., vol. 5, p. 100, 1869; Whitfield, U. S. Geol. Surv., Mon. 24, p. 69, pl. 12, figs. 4–6, 1894.

Venus plena Glenn, Maryland Geol. Surv., Miocene, p. 306, pl. 79, figs. 1, 2, 1904.

Rare; two valves merely labelled "New Jersey," and one from Jericho.

KIRKWOOD: Jericho.

Miocene Distribution. — Maryland (CALVERT, CHOPTANK), Virginia, North Carolina.

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M.

Metis bicipitata (Conrad)

Plate 12, figs. 2, 3.

Tellina bicipitata Conrad, Jour. Acad. Nat. Sci. Phila., vol. 7, p. 152, 1834.*Metis bicipitata* Glenn, Maryland Geol. Surv., Miocene, p. 301, pl. 73, figs. 5, 6, 1904.

Known from New Jersey only by broken specimens.

KIRKWOOD: Millville (310 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S).*Geological Range*.—Miocene—Pliocene.*Collections*.—U.S.N.M.**Ervilia** sp.

Plate 12, figs. 11, 12.

A few small shells, probably close to *E. planata* Dall were obtained by Woolman from a well at Sea Isle City, at the depth of 785 feet. Other young shells, probably referable to this genus, were obtained from the Woolman samples at 765, 818–863 feet at Sea Isle City.

KIRKWOOD: Sea Isle City (785 feet).

Collections.—A.N.S.P.; U.S.N.M.**Mulinia lateralis** (Say)

Plate 15, figs. 2, 3, 4, 8, 20.

Mactra lateralis Say, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 309, 1822; Tuomey and Holmes, Pleiocene Foss. S. C., p. 97, pl. 23, fig. 9, 1857; Whitfield, U. S. Geol. Surv., Mon. 24, p. 82, pl. 15, figs. 1-3, 1894.*Rangia minor* (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, pl. 84, pl. 15, figs. 4-6, 1894 (not of Conrad).

Apparently the only record for this species from the Miocene. A few specimens are known from the Atlantic City and Millville wells. Since no depth is given for the Atlantic City shells, it is possible that they came from the overlying Pleistocene. However, the Millville specimens from 385 feet are definitely Miocene.

A reexamination of the specimens from Shiloh which Whitfield identified as *Rangia minor* Conrad shows that they most probably belong to this species.

KIRKWOOD: Shiloh, Millville (385 feet), Atlantic City (depth?).

Miocene Distribution.—New Jersey.*Geological Range*.—Miocene—Recent.*Collections*.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.**Mactra delumbis** Conrad

Plate 15, figs. 16, 17.

Mactra delumbis Conrad, Fossil Shells Tert. Form., p. 26, pl. 11, 1832; Whitfield, U. S. Geol. Surv., Mon. 24, p. 82, pl. 15, fig. 10, 1894.*Spisula delumbis* Glenn, Maryland Geol. Surv., Miocene, p. 286, pl. 49, fig. 10, 1904.

Rare and known only from well borings; usually broken fragments.

KIRKWOOD: Millville (depth?), Atlantic City (936–41 feet), Sea Isle City (600–700 feet), Wildwood (800–900 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia (YORKTOWN).

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M.

***Mactra clathrodon* Lea**

Plate 15, fig. 1.

Mactra clathrodon Lea, Contrib. to Geol., p. 212, pl. 6, fig. 223, 1833; Glenn, Maryland Geol. Surv., Miocene, p. 286, pl. 49, figs. 7-9, 1904.

Very rare at Shiloh, although fairly common in many of the well samples along the coast. Lea described it from Deal, N. J., but did not give the exact locality. There are specimens in the United States National Museum collected by Whitfield from the beach at Shark River, N. J.

KIRKWOOD: Shiloh, Deal, Shark River, Ocean City (385 feet), Sea Isle City (600-700 feet), Cape May Court House (520 feet), Avalon (810, 815 feet), Wildwood (411-414, 840-860, 860-900, 920-1000 feet), Cape May (600-640 feet).

Miocene Distribution.—Maryland (CALVERT, ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.

***Mactra insulaemaris* Pilsbry and Harbison**

Plate 17, fig. 5.

Mactra insulaemaris Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 118, pl. 4, fig. 26, 1933.

Rare; "In *M. clathrodon* Lea which occurs also in the Sea Isle City well, the shape is less triangular, the anterior end being rounded, the posterior dorsal margin is less convex, and the lateral teeth are more slender, and more minutely crenulate" (Pilsbry and Harbison).

KIRKWOOD: Sea Isle City (600-700 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12558).

***Donax abseconi* new species**

Plate 15, figs. 5, 6.

Donax variabilis (Say), Whitfield, U. S. Geol. Surv., Mon. 24, p. 79, pl. 14, figs. 19, 20, 1894 (not of Say).

The type and unique specimen is a water-worn right valve. Shell small, roughly triangular, anterior margin obliquely truncate; posterior portion less obliquely truncate. Hinge typical of the genus. Valves longitudinally striated with regular fine impressed lines as in *D. variabilis* Say; basal edge within is crenate.

Dimensions.—Length 14.0 mm.; width 11.0 mm.

TYPE.—A.N.S.P. 13984.

Closely resembles *D. variabilis* Say of the Pleistocene and Recent of the Atlantic Coast, but differs from it by being shorter relative to width and by being more obliquely truncate at both ends. In general shape it resembles *D. denticulata* Linné of the Recent Gulf Coast and West Indies,

but is a lighter shell and does not have the conspicuous keel characteristic of *D. denticulata*.

Named for Absecon Island, the original name of Atlantic City.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 13984).

***Corbula elevata* Conrad**

Plate 15, figs. 9, 10.

Corbula elevata Conrad, Foss. Med. Tert., p. 7, pl. 4, fig. 3, 1838; Whitfield, U. S. Geol. Surv., Mon. 24, p. 86, pl. 15, figs. 15-19, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 280, pl. 67, figs. 4, 5, 1904.

Conrad's type locality is Stow Creek at Shiloh; not uncommon.

KIRKWOOD: Shiloh, Atlantic City (730 feet), Sea Isle City (600-700 feet), Avalon (depth?).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 14095); N.J.S.M.; U.S.N.M.; W.F.I.S.; Newk.

***Corbula idonea* Conrad**

Plate 15, figs. 7, 15.

Corbula idonea Conrad, Amer. Jour. Sci., vol. 23, p. 341, 1833; Whitfield, U. S. Geol. Surv., Mon. 24, p. 88, pl. 15, fig. 20, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 279, pl. 67, figs. 1-3, 1904.

Known only from a fragment from the Atlantic City well, but definitely recognizable as to species.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK).

Geological Range.—Miocene.

Collections.—A.N.S.P.

***Corbula inaequalis* Say**

Plate 15, figs. 13, 14.

Corbula inaequale Say, Jour. Acad. Nat. Sci. Phila., vol. 4, p. 153, pl. 13, fig. 2, 1824 (not of Conrad 1838).

Corbula subcontracta Whitfield, U. S. Geol. Surv., Mon. 24, p. 88, pl. 15, figs. 11-14, 1894; Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, p. 854, 1898.

Corbula whitfieldi Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, p. 849, pl. 36, fig. 18, 1898.

Corbula inaequalis Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, p. 853, 1898; Glenn, Maryland Geol. Surv., Miocene, p. 281, pl. 67, figs. 6-14, 1904.

A. variable species that has been given several different names which, according to Glenn, should all be synonyms of *C. inaequalis* Say.

KIRKWOOD: Shiloh, Fairton (?), Ocean City (385 feet), Cape May (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK), Virginia (CALVERT, ST. MARY'S, YORKTOWN).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M. (Type of *C. subcontracta*); W.F.I.S.; Rutg.

Corbula ima Pilsbry and Harbison

Plate 17, figs. 9, 10, 11.

Corbula ima Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 119, pl. 4, figs. 24, 27-30, 1933.

Obtained by Mr. Tullner from the Sea Isle City well. Much less sharply and regularly wrinkled than *C. cuneata* Say. "The cardinal tooth differs in shape from that of *C. franci* Gardner of Alum Bluff (Florida), a species which from the figures, seems otherwise somewhat similar" (Pilsbry and Harbison).

KIRKWOOD: Sea Isle City (600-700 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12605).

Semele burnsi (Whitfield)

Plate 15, figs. 18, 19.

Amphidesma burnsi Whitfield, U. S. Geol. Surv., Mon. 24, p. 79, pl. 14, figs. 19-20, 1894. *Abra aequalis* (Say), Whitfield, U. S. Geol. Surv., Mon. 24, p. 80, pl. 14, figs. 11-14 (not of Say).

Semele burnsi Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 5, p. 989, 1900.

Rare; according to Dall, the specimens which Whitfield figured as *Abra aequalis* Say belong to this species.

KIRKWOOD: Shiloh, Jericho.

Miocene Distribution.—New Jersey.

Geological Range.—Miocene.

Collections.—U.S.N.M. (Type).

Semele johnsoniana Pilsbry and Harbison

Plate 15, figs. 11, 12.

Semele johnsoniana Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 118, pl. 5, figs. 4-6, 1933.

Rare; collected by Johnson, Fox, and Griffiths in 1895.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—W.F.I.S. (Type).

Tellina peracuta Conrad

Tellina peracuta Conrad, Amer. Jour. Conch., vol. 2, p. 71, pl. 4, fig. 11, 1866; Whitfield, U. S. Geol. Surv., Mon. 24, p. 76, pl. 14, fig. 7, 1895.

Based upon Conrad's record but no specimen is available.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Tellina capillifera Conrad

Plate 16, fig. 1.

Tellina capillifera Conrad, Amer. Jour. Conch., vol. 2, p. 71, pl. 4, fig. 2, 1866.*Tellina shilohensis* Heilprin, Proc. Acad. Nat. Sci. Phila., vol. 39, pp. 397, 403, 1887 (not of Conrad).

Known only from two imperfect individuals. The name *T. shilohensis* appears merely in a list and was never described. The type specimen is labelled *T. shilohensis* Conrad, so possibly at one time Conrad proposed to describe the specimen under that name before he finally did publish it under the name *T. capillifera*.

KIRKWOOD: Shiloh, Wildwood (752 feet).

Miocene Distribution.—New Jersey only.*Geological Range*.—Miocene.*Collections*.—A.N.S.P. (Type 14012).**Tellina declivis** Conrad

Plate 16, figs. 2, 3, 4.

Tellina declivis Conrad, Jour. Acad. Nat. Sci. Phila., vol. 7, p. 131, 1834; Whitfield, U. S. Geol. Surv., Mon. 24, p. 77, pl. 14, figs. 4-6, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 298, pl. 72, fig. 14, 1904.

Rare and usually broken.

KIRKWOOD: Shiloh, Atlantic City (depth?).

Miocene Distribution. — Maryland (CALVERT, CHOPTANK), Virginia, South Carolina.*Geological Range*.—Miocene—Pleistocene.*Collections*.—A.N.S.P.**Tellina producta** Conrad

Plate 16, figs. 5, 6.

Tellina producta Conrad, Foss. Med. Tert., p. 36, pl. 19, fig. 5, 1840; Whitfield, U. S. Geol. Surv., Mon. 24, p. 78, pl. 14, figs. 1-3, 1894; Glenn, Maryland Geol. Surv., Miocene, p. 299, pl. 72, figs. 15, 16, 1904.

Rare; close to the above; however the anterior dorsal margin is more nearly parallel to the base while the posterior portion is more produced and the posterior dorsal margin less declining.

KIRKWOOD: Atlantic City (depth?).

Miocene Distribution.—Maryland (CALVERT, ST. MARY'S), Virginia.*Geological Range*.—Miocene—Pliocene (?).*Collections*.—A.N.S.P.**Ensis directus** (Conrad)

Plate 16, figs. 7, 8.

Solen ensis Conrad, Proc. Nat. Inst., Bull. 2, p. 191, 1842 (not of Linné).*Solen directus* Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 325, 1843.*Ensis directus* Glenn, Maryland Geol. Surv., Miocene, p. 291, pl. 71, figs. 2, 3, 1904.

This is the common Razor Clam of modern seas. Known from the New Jersey Miocene merely by fragments.

KIRKWOOD: Shiloh, Millville (285 feet), Ocean City (595 feet), Cape May Court House (520 feet).

Miocene Distribution.—Maryland (ST. MARY'S), Virginia, North Carolina, South Carolina, Florida.

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; C.M.C.H.

***Panopea whitfieldi* Dall**

Plate 14, figs. 1, 7, 8.

Panopea goldfussi (Wagner), Whitfield, U. S. Geol. Surv., Mon. 24, p. 89, pl. 16, figs. 9-13, 1894 (not of Wagner).

Panopea whitfieldi Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, p. 829, 1898; Glenn, Maryland Geol. Surv., Miocene, p. 276, pl. 65, fig. 10, 1904.

A few specimens are known from the "marly beds" at Jericho.

KIRKWOOD: Shiloh, Jericho.

Miocene Distribution.—Maryland (CALVERT, CHOPTANK), Florida.

Geological Range.—Miocene.

Collections.—U.S.N.M.; W.F.I.S.

***Saxicava myaeformis* Conrad**

Plate 16, fig. 9.

Saxicava myaeformis Conrad, Proc. Acad. Nat. Sci. Phila., vol. 14, p. 585, 1862; Whitfield, U. S. Geol. Surv., Mon. 24, p. 90, pl. 16, figs. 4, 5, 1894.

Two broken specimens, still imbedded in the clayey matrix, are the only representatives of this species.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 14014); W.F.I.S.

***Saxicava parilis* Conrad**

Plate 16, fig. 10.

Saxicava parilis Conrad, Amer. Jour. Conch., vol. 2, p. 70, pl. 4, fig. 6, 1866; Whitfield, U. S. Geol. Surv., Mon. 24, p. 92, pl. 16, fig. 6, 1894.

Only known by a single imperfect valve, still imbedded in the clayey matrix. It will be necessary to have additional specimens to learn the exact position or value of this species.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 14013).

***Saxicava arctica bilineata* Conrad**

Plate 16, figs. 13, 14.

Saxicava arctica Linné, Syst. Nat., ed. 12, p. 1113, 1767.

Saxicava bilineata Conrad, Foss. Med. Tert., p. 18, pl. 10, fig. 4, 1838; Whitfield, U. S. Geol. Surv., Mon. 24, p. 93, pl. 16, figs. 1-3, 1894.

Saxicava arctica Glenn, Maryland Geol. Surv., Miocene, p. 278, pl. 66, figs. 3-6, 1904.

All the New Jersey specimens are small, averaging 7 mm. in length. As such, they are very distinct from the usual form of *S. arctica* L. from the Pleistocene and Recent. Also, the specimens from the Miocene of Maryland reach a greater size than those from New Jersey. Although it is very

possible that *S. bilineata* is not a valid species and that it should be regarded as a synonym of *S. arctica*, for convenience the name *bilineata* is retained as a varietal designation, for the New Jersey specimens are, at least in size, very distinct from the typical *arctica*.

Possibly *S. arctica* has received as many names as any other Tertiary or Pleistocene mollusk of the Atlantic Coast. It is especially characteristic of the post Wisconsin deposits of New England and eastern Canada and as a living constituent of Arctic and sub-Arctic seas. A somewhat smaller and much thinner form, more resembling the variety *bilineata*, is known from the Pleistocene interglacial deposits of New Jersey, North and South Carolina, and has been reported living off the coast of Florida. This southern form differs from variety *bilineata* in being usually slightly larger and with a less twisted beak. For a further discussion of the synonymy of this species see Dall (Trans. Wagner Free Inst. Sci., vol. 3, pt. 4, p. 834, 1898).

KIRKWOOD: Shiloh, Jericho, Fairton.

Miocene Distribution.—(*S. arctica*) Maryland (CALVERT, CHOPTANK, ST. MARY'S).

Geological Range.—(*S. arctica*) Miocene—Recent.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; Newk.

***Mya producta* Conrad**

Plate 16, figs. 11, 12.

Mya producta Conrad, Foss. Med. Tert., p. 1, pl. 1, fig. 1, 1838; Glenn, Maryland Geol. Surv., Miocene, p. 283, pl. 68, figs. 1, 2, 1904.

Fragments only.

KIRKWOOD: Shiloh.

Miocene Distribution.—Maryland (CHOPTANK), Virginia.

Geological Range.—Miocene.

Collections.—A.N.S.P.

***Periploma peralta* Conrad**

Plate 17, fig. 2.

Periploma alta Conrad, Proc. Acad. Nat. Sci. Phila., vol. 14, pp. 572, 585, 1863 (not *Anatina alta* Adams).

Periploma alta Whitfield, U. S. Geol. Surv., Mon. 24, p. 85, pl. 16, figs. 7, 8, 1894.

Periploma peralta Conrad, Amer. Jour. Conch., vol. 3, p. 188, 1867; Glenn, Maryland Geol. Surv., Miocene, p. 359, pl. 95, fig. 3, 1904.

Very rare and represented in New Jersey only by poor material.

KIRKWOOD: Shiloh.

Miocene Distribution.—Maryland (ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 13989); W.F.I.S.

AMPHINEURA

***Chaetopleura apiculata* (Say)**

Plate 18, figs. 1, 2.

Chiton apiculatus Say, Amer. Conch., vol. 7, Appendix, 1834?

Chiton transenna H. C. Lea, New Fossil Shells from Tert. of Va., p. 5, 1843; Trans. Amer. Philos. Soc., vol. 9, p. 246, pl. 35, fig. 35, 1845.

Chaetopleura apiculatus Martin, Maryland Geol. Surv., Miocene, p. 270, pl. 64, figs. 1, 2, 1904.

Numerous valves were found at Shephard's pit, Shiloh, by H. A. Pilsbry and Miss Harbison in 1931 and by Mr. Tullner from the Sea Isle City well.

KIRKWOOD: Shiloh, Sea Isle City (600–700 feet).

Miocene Distribution.—Maryland (CALVERT), Virginia.

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; N.J.S.M.

GASTROPODA

Fissuridea griscomi (Conrad)

Plate 21, fig. 9.

Fissurella griscomi Conrad, Jour. Acad. Nat. Sci. Phila., p. 143, 1834; Whitfield, U. S. Geol. Surv., Mon. 24, p. 136, pl. 24, figs. 11–14, 1894.

Fissuridea griscomi Martin, Maryland Geol. Surv., Miocene, p. 267, pl. 63, figs. 2a, 2b, 3a, 3b, 1904.

A common species at the Shephard's Pits.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Ocean City (730 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK).

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 14435); N.J.S.M.; U.S.N.M.; W.F.I.S.; Rutg.; Newk.

Calliostoma eboreum (Conrad)

Plate 18, fig. 3.

Trochus eboreus Conrad, Jour. Acad. Nat. Sci. Phila., vol. 8, p. 52, pl. 1, fig. 5, 1839.

Monilea eborea Whitfield, U. S. Geol. Surv., Mon. 24, p. 135, pl. 24, figs. 7–10, 1894.

Calliostoma eboreum Martin, Maryland Geol. Surv., Miocene, p. 259, pl. 61, fig. 7, 1904; Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 116, pl. 5, figs. 8, 9, 1933.

Rare, known only from a few specimens.

KIRKWOOD: Shiloh, Jericho, Millville (depth?), Cape May (420–460 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK).

Geological Range.—Miocene.

Collections.—N.J.S.M.; U.S.N.M.; W.F.I.S.

Calliostoma tullneri Pilsbry and Harbison

Plate 17, fig. 22.

Calliostoma tullneri Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 116, pl. 4, fig. 17, 1933.

Known only from type lot obtained by Mr. William Tullner, Jr., from the Sea Isle City well.

KIRKWOOD: Sea Isle City (600–700 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12556).

Turritella cumberlandia Conrad

Plate 18, figs. 5, 6.

Turritella cumberlandia Conrad, Proc. Acad. Nat. Sci. Phila., vol. 14, p. 584, 1863; Whitfield, U. S. Geol. Surv., Mon. 24, p. 129, pl. 23, figs. 9–11, 1894.

Turritella variabilis cumberlandia Martin, Maryland Geol. Surv., Miocene, p. 237, pl. 57, figs. 3, 4, 1904.

Probably the most common species from the Miocene of New Jersey, and although known from Maryland is much more characteristic of New Jersey.

KIRKWOOD: Shiloh, Bridgeton, Atlantic City (936-41 feet), Ocean City (595 feet), Sea Isle City (600-700 feet), Cape May Court House (520 feet), Avalon (depth?), Wildwood (718-32, 887-930 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; C.M.C.H.; A.M.N.H.; Rutg.; Newk.

***Turritella acquistriata* Conrad**

Plate 18, figs. 7, 8.

Turritella acquistriata Conrad, Proc. Acad. Nat. Sci. Phila., vol. 14, p. 584, 1863; Whitfield, U. S. Geol. Surv., Mon. 24, p. 128, pl. 23, figs. 12-14, 1894; Martin, Maryland Geol. Surv., Miocene, p. 234, pl. 56, fig. 3, 1904.

Usually found with the above but not as common.

KIRKWOOD: Shiloh, Jericho, Ocean City (385 feet), Sea Isle City (600-700 feet), Wildwood (881-930 feet), Cape May (1010 feet).

Miocene Distribution.—Maryland (CALVERT), North Carolina, Georgia.

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; Rutg.; Newk.

***Turritella plebia* Say**

Plate 18, figs. 4, 9.

Turritella plebia Say, Jour. Acad. Nat. Sci. Phila., vol. 4, p. 125, pl. 7, fig. 1, 1824; Whitfield, U. S. Geol. Surv., Mon. 24, p. 130, pl. 23, figs. 6-8, 1894; Martin, Maryland Geol. Surv., Miocene, p. 234, pl. 56, figs. 4-9, 1904.

Whorls much more convex than *T. acquistriata* Conrad, and covered with fine uniform, or uniformly alternating raised revolving striae. Not as common as the two preceding species.

KIRKWOOD: Shiloh, Atlantic City (450 feet), Ocean City (515, 730 feet), Avalon (depth?), Cape May (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.

***Turritella secta* Conrad**

Plate 18, figs. 10, 11.

Turritella secta Conrad, Proc. Acad. Nat. Sci. Phila., vol. 7, p. 268, 1855; Whitfield, U. S. Geol. Surv., Mon. 24, p. 129, pl. 23, figs. 15-17, 1894.

Conrad described the species from "near Mullica Hill," but this is probably an error since there are no Miocene deposits in that vicinity. Whitfield's figured specimens in the New Jersey State Museum are labelled "Cumberland County, N. J." There is also a fragment of this species in the Academy of Natural Sciences from a well at Atlantic City. It was also present in the Millville well.

Apparently a rare species and not found beyond New Jersey.

KIRKWOOD: "Cumberland County," Millville (depth?), Atlantic City (depth?), Wildwood (920-1000 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.

Solarium trilineatum Conrad

Plate 17, fig. 16.

Solarium trilineatum Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 31, 1841; Martin, Maryland Geol. Surv., Miocene, p. 241, pl. 58, fig. 3 a, b, c, 1904.

Known from New Jersey only by a single young specimen obtained from the Brigantine well.

KIRKWOOD: Brigantine (625-651 feet).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P.

Vermetus graniferus (Say)

Plate 18, figs. 12, 13.

Serpula granifera Say, Jour. Acad. Nat. Sci. Phila., vol. 4, p. 154, pl. 8, fig. 4, 1824.

Anguinella virginiana (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 132, pl. 24, figs. 1-5, 1894 (not of Conrad).

Vermetus graniferus Martin, Maryland Geol. Surv., Miocene, p. 232, pl. 55, figs. 14, 15, 1904.

Whitfield recorded small fragments of the apical portions of shells which he identified as *Anguinella virginiana* Conrad. According to Martin these should have been identified as *Vermetus graniferus* (Say). Recently additional material has been obtained from the Cape May Court House well and Sea Isle City well.

KIRKWOOD: Jericho, Sea Isle City (600-700 feet); Cape May Court House (520 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia, North Carolina, Florida.

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; C.M.C.H.

Melanella retrocita Pilsbry and Harbison

Plate 17, fig. 17.

Melanella retrocita Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 116, pl. 4, fig. 15, 1933.

Type and paratype collected by Dr. Pilsbry and Miss Harbison in 1931. Rare and unrelated to any other form in the Atlantic Coast Miocene.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12596A).

Cerithidea insulaemaris Pilsbry and Harbison

Plate 21, fig. 18.

Cerithidea insulaemaris Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 115, pl. 4, figs. 20, 21, 1933.

Known only from the type lot obtained by Mr. Tullner from the Sea Isle City well. This species is the type of the subgenus *Cerithideops* Pilsbry.

KIRKWOOD: Sea Isle City (600–700 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12560).

Seila clavulus (Lea)

Plate 18, fig. 15.

Cerithium clavulus Lea, New Fossil Shells from the Tertiary of Virginia, 1843.

Cerithium adamsii Lea, Trans. Amer. Philos. Soc., vol. 9, p. 268, 1845.

Seila adamsii Martin, Maryland Geol. Surv., Miocene, p. 228, p. 55, fig. 6, 1904.

Rare and easily overlooked because of its small size.

KIRKWOOD: Shiloh, Ocean City (730 feet), Avalon (depth?).

Miocene Distribution. — Maryland (CALVERT, CHOPTANK), Virginia, North Carolina, Florida.

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.

Triphora terebrata Heilprin

Plate 21, fig. 20.

Triforis terebrata Heilprin, Proc. Acad. Nat. Sci. Phila., vol. 39, p. 405, 1887; Whitfield, U. S. Geol. Surv., Mon. 24, p. 133, pl. 24, fig. 6, 1894.

Apparently very rare, only a few specimens being known.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 14032).

Scalaria marylandica (Martin)

Plate 18, fig. 14.

Scalaria multistriata (Say), Whitfield, U. S. Geol. Surv., Mon. 24, p. 126, pl. 23, fig. 5, 1894 (not *Scalaria multistriata* Say).

Scala marylandica Martin, Maryland Geol. Surv., Miocene, p. 213, pl. 53, fig. 3, 1904.

According to Martin the New Jersey specimens are not *S. multistriata* Say but should be referred to *S. marylandica* Martin which he described from the Miocene of Maryland. Very rare in New Jersey.

KIRKWOOD: Jericho, Cape May (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK).

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M. (Type of *S. marylandica*).

Turbonilla interrupta Totten

Plate 20, fig. 13.

Turbonilla interrupta Totten, Amer. Jour. Sci., vol. 28, p. 352, fig. 7, 1835; Martin, Maryland Geol. Surv., Miocene, p. 224, pl. 44, figs. 13, 14, 1904.

One small lot from Shiloh and a few questionable specimens from Cape May Court House mark the only records of this species from the Miocene

of New Jersey. The species is known from the Pleistocene and Recent of the State.

KIRKWOOD: Shiloh, Cape May Court House (520 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), North Carolina.

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; W.F.I.S.

?*Fossarus lyra* (Conrad)

Plate 17, figs. 18, 19.

Delphinula lyra Conrad, Jour. Acad. Nat. Sci. Phila., vol. 7, p. 141, 1835.

Carinorbis lyra Conrad, Proc. Acad. Nat. Sci. Phila., vol. 14, pp. 288, 570, 1863.

Fossarus lyra Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 2, p. 322, pl. 18, fig. 3a, 1892.

One specimen apparently referable to this species is in the collection of the New Jersey State Museum labelled "Ayers Pits, Shiloh." It is too imperfect for positive identification.

KIRKWOOD: Shiloh.

Miocene Distribution.—Virginia, North Carolina.

Geological Range.—Miocene.

Collections.—N.J.S.M.

Fossarus dalli (Whitfield)

Plate 18, fig. 16.

Carinorbis globulus (Lea), Heilprin, Proc. Acad. Nat. Sci. Phila., vol. 39, p. 404, 1887 (not of H. C. Lea).

Trichotropis dalli Whitfield, U. S. Geol. Surv., Mon. 24, p. 127, pl. 23, figs. 1-4, 1894.

Fossarus dalli Martin, Maryland Geol. Surv., Miocene, p. 240, pl. 58, fig. 2, 1904.

Rare.

KIRKWOOD: Shiloh, Jericho.

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M. (Type); W.F.I.S.

Calyptrea aperta (Solander)

Plate 18, figs. 23, 24.

Trochus apertus Solander, Foss. Haut., p. 9, figs. 1, 2, 1766.

Infundibulum perarmatum Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 31, 1841.

Trochita perarmata Whitfield, U. S. Geol. Surv., Mon. 24, p. 124, pl. 22, figs. 15-19, 1894.

Calyptrea aperta Martin, Maryland Geol. Surv., Miocene, p. 247, pl. 69, fig. 1, 1904.

Fairly common at Shephard's Pits today. Although most of the specimens are small (13 mm.) and without conspicuous spines (Plate 18, fig. 24), larger specimens with prominent spines were obtained from the Millville well (Plate 18, fig. 23). These latter individuals resemble material from Plum Point, Maryland.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Millville (500-520 feet), Atlantic City (873-895, 936-941 feet), Ocean City (730 feet), Cape May Court House (520 feet), Avalon (810 feet), Cape May (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK).

Geological Range.—Eocene—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U. S. N. M.; W. F. I. S.; C. M. C. H.; Rutg.; Newk.

***Crepidula fornicata* (Linné)**

Plate 18, fig. 17.

Patella fornicata Linné, Syst. Nat., ed. 10, p. 781, 1758.

Crepidula fornicata Lamarck, An. Sans Vert., vol. 7, p. 641, 1801; Whitfield, U. S. Geol. Surv., Mon. 24, p. 123, 1894; Martin, Maryland Geol. Surv., Miocene, p. 249, pl. 59, fig. 4, 1904.

A few poor specimens were obtained from Shiloh and a number of perfect shells from the Cape May Court House well. Not characteristic of the Miocene of New Jersey, although common in the Pleistocene.

KIRKWOOD: Shiloh (?), Bridgeton (?), Cape May Court House (520 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia.

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; U.S.N.M.(?); W.F.I.S.; C.M.C.H.

***Crepidula plana* Say**

Plate 18, figs. 18-20.

Crepidula plana Say, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 226, 1822; Whitfield, U. S. Geol. Surv., Mon. 24, p. 124, 1894; Martin, Maryland Geol. Surv., Miocene, p. 250, pl. 59, fig. 5, 1904.

Whitfield recorded only a single fragment which he questionably referred to this species. More recently specimens have been obtained from Shiloh and several wells.

KIRKWOOD: Shiloh, Millville (430 feet), Avalon (depth?).

Miocene Distribution.—Maryland (CHOPTANK, ST. MARY'S), Virginia (YORKTOWN), Florida.

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; Rutg.

***Crucibulum costatum* (Say)**

Plate 18, figs. 21, 22.

Calyptraea costata Say, Amer. Jour. Sci., vol. 2, p. 40, 1821.

Crucibulum costatum Whitfield, U. S. Geol. Surv., Mon. 24, p. 122, pl. 22, figs. 11-14, 1894; Martin, Maryland Geol. Surv., Miocene, p. 244, pl. 58, fig. 7, 1904.

This is a very variable species and is common in the Shephard pits today.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Millville (depth?), Avalon (depth?), Cape May (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK), Virginia.

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; Rutg.; Newk.

Xenophora conchyliophora (Born)

Plate 19, figs. 1, 2.

Trochus conchyliophorus Born, Testacea Musei Caesarei Vindobornensis, p. 333, pl. 12, figs. 21-22, 1780.*Phorus reclusus* Conrad, Proc. Acad. Nat. Sci. Phila., vol. 7, p. 262, 1855.*Xenophora conchyliophora*, Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 2, p. 360, pl. 4, figs. 10, 10a, 1892; Martin, Maryland Geol. Surv., Miocene, p. 251, pl. 59, fig. 7, 1904.

There are a few shells of this species in the Miocene Collections of the New Jersey State Museum merely labeled "New Jersey."

KIRKWOOD: ? "New Jersey."

Miocene Distribution.—Maryland (CALVERT, CHOPTANK), North Carolina, Florida.

Geological Range.—Cretaceous—Recent.

Collections.—A.N.S.P.; N.J.S.M.

Polinices heros (Say)

Plate 19, fig. 6.

Natica heros Say, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 248, 1822; Whitfield, U. S. Geol. Surv., Mon. 24, p. 119, pl. 22, figs. 9-10, 1894.*Polynices heros* Martin, Maryland Geol. Surv., Miocene, p. 253, pl. 60, figs. 3, 4, 1904.*Natica catenoides* Conrad, Proc. Acad. Nat. Sci. Phila., vol. 14, p. 565, 1863 (not of Wood).

This is the common *Polinices* of the northeast coast. Numerous species resembling *P. heros* have been listed from the Miocene of New Jersey and Maryland, but they apparently should all be referred to *P. heros*. For bibliography and discussion see Whitfield pp. 119-120 and Martin pp. 253-254.

The species is not common in the Miocene of New Jersey, but is present in the Pleistocene (CAPE MAY) of New Jersey.

KIRKWOOD: Shiloh, Jericho, Millville, Atlantic City (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia.

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; U.S.N.M.; Rutg.

Polinices triseriata (Say)

Plate 19, fig. 7.

Natica triseriata Say, Jour. Acad. Nat. Sci. Phila., vol. 5, p. 209, 1825.

This form is usually regarded as a color variety or young of *Polinices heros* Say. A few shells, from the Millville well, are apparently the first records of this form from the Miocene.

KIRKWOOD: Millville (depth?).

Miocene Distribution.—New Jersey.

Geological Range.—Miocene—Recent.

Collections.—U.S.N.M.

Polinices duplicata (Say)

Plate 19, figs. 3, 4.

Natica duplicata Say, Jour. Acad. Nat. Sci. Phila., vol. 2, p. 247, 1822.*Neverita duplicata* Whitfield, U. S. Geol. Surv., Mon. 24, p. 121, pl. 21, figs. 13-16, 1894.*Polynices duplicata* Martin, Maryland Geol. Surv., Miocene, p. 252, pl. 60, fig. 1, 1904.

Occasional in the Miocene of New Jersey although more common in the Pleistocene (CAPE MAY) and recent.

KIRKWOOD: Shiloh, Jericho, Millville (depth?), Atlantic City (873-95 feet), Ocean City (595, 730 feet), Cape May Court House (520 feet), Avalon (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia, Florida.

Geological Range.—Miocene—Recent.

Collections.—A. N. S. P.; N. J. S. M.; U. S. N. M.; W. F. I. S.; C. M. C. H.; Newk.

***Polinices hemicrypta* (Gabb)**

Plate 19, figs. 8, 9.

Natica hemicrypta Gabb, Jour. Acad. Nat. Sci. Phila., ser. 2, vol. 4, p. 375, pl. 67, fig. 5, 1860; Whitfield, U. S. Geol. Surv., Mon. 24, p. 118, pl. 22, figs. 1-5, 1894.

Polynices hemicryptus Martin, Maryland Geol. Surv., Miocene, p. 252, pl. 60, fig. 2, 1904.

KIRKWOOD: Shiloh, Jericho, Millville (470 feet), Sea Isle City (600-700 feet), Avalon (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK), Florida.

Geological Range.—Miocene.

Collections.—A. N. S. P.; N. J. S. M.; U. S. N. M.; W. F. I. S.; Rutg.; Newk.

***Polinices tuomeyi* (Whitfield)**

Plate 19, fig. 5.

Natica tuomeyi Whitfield, U. S. Geol. Surv., Mon. 24, p. 120, pl. 22, figs. 6-8, 1894.

Somewhat resembles *N. heros* but with more vertical axis, rounder and more exsert inner volutions, giving a proportionally higher spire (Whitfield). The specimen figured as *N. heros* Say in Tuomey and Holmes (Pleiocene Fossils of South Carolina) is thought by Whitfield to be a large example of this species.

KIRKWOOD: Shiloh, Jericho, Sea Isle City (600-700 feet)?

Miocene Distribution.—New Jersey.

Geological Range.—Miocene—Pliocene(?).

Collections.—A. N. S. P.; U. S. N. M. (Type); W. F. I. S.

***Sinum fragile* (Conrad)**

Plate 19, fig. 13.

Natica fragilis Conrad, Jour. Acad. Nat. Sci. Phila., vol. 6, p. 222, pl. 9, fig. 3, 1830.

Sigaretus fragilis Martin, Maryland Geol. Surv., Miocene, p. 255, pl. 60, fig. 5, 1904.

Very rare. Known from New Jersey only by one broken specimen obtained from the well at Cape May Court House and by a single individual from Shiloh in the Wagner Institute.

KIRKWOOD: Shiloh, Cape May Court House (520 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia.

Geological Range.—Miocene.

Collections.—A. N. S. P.; W. F. I. S.

Erato perexigua (Conrad)

Plate 19, fig. 12.

Marginella perexigua Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 32, 1841.*Erato emmonsii* Whitfield, U. S. Geol. Surv., Mon. 24, p. 108, pl. 19, figs. 9-11, 1894.*Erato perexigua* Martin, Maryland Geol. Surv., Miocene, p. 227, pl. 55, fig. 5, 1904.

Whitfield described *E. emmonsii* from Jericho, New Jersey; however, Martin pointed out that the form was identical with *E. perexigua* (Conrad) from the Miocene of Maryland.

KIRKWOOD: Jericho.

Miocene Distribution.—Maryland (CALVERT), North Carolina(?).*Geological Range*.—Miocene.*Collections*.—U.S.N.M. (Type of *E. emmonsii*).**Ecphora tricostrata** Martin

Plate 19, fig. 15.

Ecphora tricostrata Martin, Maryland Geol. Surv., Miocene, p. 209, pl. 52, figs. 5-8, 1904.

Although fairly common and characteristic in Maryland, shells obtained from the Sea Isle City and Millville wells are the only records from New Jersey.

KIRKWOOD: Millville (depth?), Sea Isle City (600-700 feet).

Miocene Distribution.—Maryland (CALVERT).*Geological Range*.—Miocene.*Collections*.—A.N.S.P.; U.S.N.M.**Rapana ecclesiastica** Dall

Plate 19, fig. 19.

Rapana tampaensis var. Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 2, p. 244, pl. 20, fig. 14, 1892.*Fasciolaria sulcosa* (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 100, pl. 17, figs. 9, 10, 1894 (not of Conrad).*Ecphora tampaensis* (Dall), Martin, Maryland Geol. Surv., Miocene, p. 211, 1904 (in part).*Rapana ecclesiastica* Dall, U. S. Nat. Mus., Bull. 90, p. 78, 1915.

Whitfield's original figured specimen, supposedly in the United States National Museum, has apparently been lost, since it could not be located after a careful search. There is, however, a specimen in the Academy of Natural Sciences obtained by Mr. Tullner from the Sea Isle City well. The type specimen of *R. ecclesiastica* comes from Maryland and is in the United States National Museum.

KIRKWOOD: Jericho, Sea Isle City (depth 600-700 feet).

Miocene Distribution.—Maryland (CALVERT).*Geological Range*.—Miocene.*Collections*.—A.N.S.P.; U.S.N.M.(?); W.F.I.S.**Muricidea shilohensis** (Heilprin)

Plate 19, fig. 11

Murex shilohensis Heilprin, Proc. Acad. Nat. Sci. Phila., vol. 39, p. 404, 1887; Whitfield, U. S. Geol. Surv., Mon. 24, p. 97, pl. 17, fig. 1, 1894.*Muricidea shilohensis* Martin, Maryland Geol. Surv., Miocene, p. 202, pl. 51, figs. 4-6, 1904.

The only New Jersey records are the type obtained by Miss Emma Walter from the Ayres pits in Shiloh, and some specimens obtained by Mr. William Tullner, Jr., from the Sea Isle City well.

KIRKWOOD: Shiloh, Sea Isle City (600–700 feet).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 4081).

Muricidea burnsi (Whitfield)

Plate 19, fig. 10.

Murex shilohensis burnsi Whitfield, U. S. Geol. Surv., Mon. 24, p. 98, pl. 17, fig. 2, 1894. Cf. Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 1, p. 141, 1890.

One specimen, imperfect in the apex, is in the United States National Museum. According to Dall, this is not a variety of *M. shilohensis* Heilprin, but a distinct species.

KIRKWOOD: Jericho.

Miocene Distribution.—Florida (Ballast Point?).

Geological Range.—Miocene.

Collections.—U.S.N.M. (Type).

Murex millvillensis new species

Plate 19, fig. 16.

Shell subfusiform with three elevated varices, and an intermediate prominent irregular longitudinal ridge; between two of the varices on the body whorl is a smaller ridge. Revolving lines are prominent, occurring in groups of three separated by slightly thicker spiral ridges; longitudinal wrinkles distinct; canal long. Twelve teeth on the aperture.

This differs from *Murex mississippiensis* (Conrad) by having three spiral lines instead of one or two. Also *M. mississippiensis* does not have the 12 aperture teeth, but instead has six prominent lines on the labium; also the ridge is straighter along the body whorl and does not curve as in *M. millvillensis*.

Measurements

Type (U.S.N.M. 498975) length 32.5 mm., width 19.0 mm.

Paratype length 30.8 mm., width 17.0 mm.

Paratype length 26.0 mm., width 15.0 mm.

Three specimens including the type, were found in the Millville well at a depth of 505 feet. Three others occurred at a depth of 460 feet.

Murex mississippiensis (Conrad) was described from the Vicksburg (Oligocene) formation of Mississippi.³² Later, Heilprin³³ described a related species from the Miocene beds (Tampa limestone) of Florida as *M. tritonopsis*. Dall,³⁴ however, believed that the two were synonymous.

KIRKWOOD: Millville (460, 505 feet).

³² T. A. Conrad, Jour. Acad. Nat. Sci. Phila., ser. 2, vol. 1, p. 116, pl. 11, fig. 30, 1848.

³³ A. Heilprin, Trans. Wagner Free Inst. Sci., vol. 1, p. 107, pl. 15, fig. 39, 1887.

³⁴ W. H. Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 1, p. 139, 1890.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—U.S.N.M. (Type).

***Coralliophila cumberlandiana* (Gabb)**

Plate 19, fig. 18.

Cantharus cumberlandianus Gabb, Jour. Acad. Nat. Sci. Phila., ser. 2, vol. 4, p. 375, pl. 67, fig. 6, 1860; Whitfield, U. S. Geol. Surv., Mon. 24, pl. 103, pl. 17, figs. 3-6, 1894.

Coralliophila cumberlandiana Martin, Maryland Geol. Surv., Miocene, p. 211, pl. 51, figs. 18-20, 1904.

Not common.

KIRKWOOD: Shiloh, Jericho, Millville (depth?), Sea Isle City (600-700 feet).

Miocene Distribution.—Maryland (CHOPTANK, ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 4314); N.J.S.M.; U.S.N.M.; W.F.I.S.

***Mitrella communis mediocris* Pilsbry and Harbison**

Plate 19, fig. 20.

Amycla communis (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, pl. 110, pl. 19, figs. 12-15, 1894 (in part).

Mitrella communis mediocris Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 114, pl. 4, fig. 16, 1933.

An abundant species at Shiloh and constantly smaller than the typical *M. communis* Conrad from Maryland.

KIRKWOOD: Shiloh, Jericho, Ocean City (730 feet), Cape May (depth?).

Miocene Distribution.—New Jersey only; typical *communis* is reported from the CALVERT, CHOPTANK and ST. MARY'S of Maryland, South Carolina.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12590); N.J.S.M.; U.S.N.M.; W.F.I.S.; Newk.

***Mitrella laevis* (Whitfield)**

Plate 19, figs. 14, 15.

Strombina laevis Whitfield, U. S. Geol. Surv., Mon. 24, p. 111, pl. 20, figs. 1-4, 1894.

Mitrella laevis Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 114, pl. 4, fig. 25, 1933.

Far less abundant than *M. communis mediocris* Pilsbry and Harbison.

KIRKWOOD: Shiloh, Jericho, Millville (depth?), Ocean City (515 feet), Sea Isle City (600-700 feet), Avalon (depth?).

Miocene Distribution.—South Carolina (Whitfield).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M. (Type); W.F.I.S.

***Siphonalia devexa* (Conrad)**

Plate 20, fig. 1.

Fusus deverus Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 309, 1843.

Siphonalia devexa Martin, Maryland Geol. Surv., Miocene, p. 185, pl. 47, figs. 5, 6, 1904.

A very young shell was obtained from the Sea Isle City well while several specimens including one very perfect individual came from the Millville well.

KIRKWOOD: Millville (515 feet), Sea Isle City (600-700 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK).

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M.

Busycon scalarispira Conrad

Plate 20, figs. 4, 5, 6.

Busycon scalarispira Conrad, Proc. Acad. Nat. Sci. Phila., vol. 14, p. 584, 1862; Whitfield, U. S. Geol. Surv., Mon. 24, p. 102, pl. 17, figs. 11, 12, 1894.

Only small shells have been found of this species which is apparently restricted to New Jersey.

KIRKWOOD: Shiloh, Jericho, Millville (460 feet), Sea Isle City (600-700 feet), Cape May Court House (520 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A. N. S. P.; N. J. S. M.; U.S.N.M.; W.F.I.S.; C.M.C.H.; Newk.

Busycon tuberculatum (Conrad)

Plate 20, fig. 2.

Fulgur tuberculatus Conrad, Foss. Medial Tert., no. 2, cover, 1840; Martin, Maryland Geol. Surv., Miocene, p. 179, pl. 44, fig. 4, 1904.

A few shells known from the Millville well.

KIRKWOOD: Millville (depth?).

Miocene Distribution.—Maryland (ST. MARY'S).

Geological Range.—Miocene.

Collections.—U.S.N.M.

Nassarius trivittatoides (Whitfield)

Plate 20, figs. 7, 11.

Tritia trivittatoides Whitfield, U. S. Geol. Surv., Mon. 24, p. 104, pl. 19, figs. 1-3, 1894.

Nassa trivittatoides Martin, Maryland Geol. Surv., Miocene, p. 192, pl. 49, figs. 3, 4, 1904.

The most abundant species of *Nassarius* at Shiloh.

KIRKWOOD: Shiloh, Jericho, Atlantic City (873-95, 936-41 feet), Ocean City (385, 730 feet), Sea Isle City (600-700 feet), Avalon (815 feet), Cape May (420-460, 1010 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M. (Type); W.F.I.S.; Rutg.; Newk.

Nassarius trivittatoides elongata (Whitfield)

Plate 20, fig. 10.

Tritia trivittatoides elongata Whitfield, U. S. Geol. Surv., Mon. 24, p. 105, pl. 19, fig. 406, 1894.

According to Whitfield the variety differs from the typical species in being proportionately much more slender and by possessing a greater number of vertical lines as well as two additional spiral lines on the body whorl. There are also, according to Whitfield, a few other minor differences.

Martin (Maryland Geol. Surv., Miocene, p. 193) reports that both forms occur in the Miocene of Maryland and that they can not be separated.

KIRKWOOD: Shiloh, Jericho, Avalon (depth?).

Miocene Distribution.—Maryland (CALVERT?, CHOPTANK).

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M. (Type).

Nassarius bidentata (Emmons)

Plate 20, fig. 12.

Buccinum bidentatum Emmons, N. C. Geol. Surv., p. 157, fig. 126, 1858.

Tritia bidentata Whitfield, U. S. Geol. Surv., Mon. 24, p. 106, pl. 19, fig. 7, 1894.

Easily distinguished from *N. trivittatoides* by being shorter and more robust; not as common.

KIRKWOOD: Shiloh, Avalon (depth?).

Miocene Distribution.—Virginia, North Carolina, Florida.

Geological Range.—Miocene—Pliocene.

Collections.—U.S.N.M.; W.F.I.S.

Nassarius sopora (Pilsbry and Harbison)

Plate 20, figs. 8, 9.

Nassa sopora Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 114, pl. 3, figs. 9, 10, 1933.

Type and paratype obtained by Mr. Tullner from the Sea Isle City well; also rare at Shephard's Pits at Shiloh, collected by Pilsbry and Harbison in 1931. The species is apparently close to *N. peraltoides* Martin from the Calvert and Choptank formations, but in that shell the ribs and spiral grooves are more numerous.

KIRKWOOD: Shiloh, Sea Isle City (600–700 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12604).

Bulliopsis integra (Conrad)

Plate 21, figs. 7, 8.

Buccinum integrum Conrad, Proc. Nat. Inst., Bull. 2, p. 194, pl. 2, fig. 5, 1842.

Buccinanops variabilis Whitfield, U. S. Geol. Surv., Mon. 24, p. 107, pl. 17, figs. 13-18, 1894.

Bulliopsis integra Martin, Maryland Geol. Surv., Miocene, p. 197, pl. 50, figs. 1, 2, 1904.

According to Martin the shells which Whitfield described as *Buccinanops variabilis* were young specimens of *Bulliopsis integra* (Conrad). The only New Jersey specimens came from wells at Wildwood, Cape May, and Cape May Point. Woolman and Heilprin identified some of these specimens as *Bulliopsis marylandica* (Conrad), but further study has shown them all to be *B. integra* (Conrad).

KIRKWOOD: Wildwood (611–618 feet), Cape May (320–350 feet), Cape May Point (456 feet).

Miocene Distribution.—Maryland (St. MARY's).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M. (Type of *B. variabilis*); U.S.N.M.

Fasciolaria woodi Gabb

Plate 19, fig. 17.

Fasciolaria woodi Gabb, Jour. Acad. Nat. Sci. Phila., ser. 2, vol. 4, p. 375, pl. 67, fig. 7, 1860; Whitfield, U. S. Geol. Surv., Mon. 24, p. 98, pl. 17, figs. 7, 8, 1894.

Known from only three specimens, from Shiloh, New Jersey, and some broken individuals in the Atlantic City well.

According to Dall (Trans. Wagner Free Inst. Sci., vol. 3, pl. 1, p. 105), this species is identical with *Cuma tectum* Gabb (not Wood) from the Miocene of Santo Domingo. However, because of the poor quality of the New Jersey shells, this identification must be regarded as uncertain.

KIRKWOOD: Shiloh, Atlantic City (895-931 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 14038); W.F.I.S.

Oliva sayana Ravenel

Plate 17, fig. 20; pl. 21, fig. 6.

Oliva litterata Lamarck, Ann. du Mus., Paris, vol. 16, p. 315, 1810 (not *Porphyria literata* Bolten).

Oliva sayana Ravenel, Catalogue, p. 19, 1834.

Dactylus carolinensis Conrad, Proc. Acad. Nat. Sci. Phila., vol. 14, pp. 563, 584, 1862.

Oliva carolinensis (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 109, pl. 19, fig. 8, 1894.

Oliva literata Martin, Maryland Geol. Surv., Miocene, p. 169, pl. 44, figs. 1 a, 1 b, 1904.

Known from New Jersey only by a fragment from Jericho and a young individual from the Avalon well.

O. sayana is common in the Pleistocene and Recent from North Carolina southward.

KIRKWOOD: Jericho, Avalon (depth?).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S), Virginia.

Geological Range.—Miocene—Recent.

Collections.—A.N.S.P.; U.S.N.M.

Cancellaria alternata Conrad

Plate 21, fig. 1.

Cancellaria alternata Conrad, Jour. Acad. Nat. Sci. Phila., vol. 7, p. 155, 1834; Whitfield, U. S. Geol. Surv., Mon. 24, p. 112, pl. 20, figs. 5-10, 1894; Martin, Maryland Geol. Surv., Miocene, p. 161, pl. 43, figs. 1-3, 1904; Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 108, pl. 3, figs. 2, 3, 1933.

Fairly common at Shephard's Pits today. The type (A.N.S.P. 4818) is from the Choptank River, Maryland.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Sea Isle City (600-700 feet), Wildwood (840-860 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M.; U.S.N.M.; W.F.I.S.; Rutg.

Cancellaria shilohensis Pilsbry and Harbison

Plate 21, fig. 33.

Cancellaria shilohensis Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 108, pl. 3, fig. 8, 1933.

Type collected by Dr. Pilsbry and Miss Harbison from Shephard's Pits in 1931.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12600); U.S.N.M.; W.F.I.S.

Cancellaria reticulatoides Martin

Plate 21, figs. 2, 3.

Cancellaria reticulatoides Martin, Maryland Geol. Surv., Miocene, p. 164, pl. 43, fig. 7, 1904.

Four specimens were obtained from the Millville well. One specimen has one denticle between the three columellar plaits, while the other three have two denticle teeth between the columellar plaits.

KIRKWOOD: Millville (460–470 feet).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—U.S.N.M.

Trigonostoma beatum Pilsbry and Harbison

Plate 17, fig. 21.

Trigonostoma beatum Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 108, pl. 3, fig. 1, 1933.

One specimen (Type) found by Pilsbry and Harbison in 1930, from Shephard's Pits; also three broken specimens are in the Wagner Institute collected by Johnson, Fox, and Griffiths in 1895. "*T. beatum* appears isolated in the Atlantic coast Miocene, but related species occur in the Miocene of Santo Domingo" (Pilsbry and Harbison).

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12599); U.S.N.M.; W.F.I.S.

Trigonostoma planasuturata new species

Plate 21, figs. 4, 5.

The shell is small with irregular oblique prominent ribs and equal spiral lines; spire very short and conical; the whorls have sutures with flattened plane; aperture ovate and occupying about half the length of the shell. Labrum striated within; columella with three compressed plaits; longitudinal oblique ribs are close together and crossed by 13 spiral ridges on the lower whorl. It is probable that there are two oblique denticles between the second and third columellar plait, but the fossil is worn and this feature cannot be observed with certainty. The shell has four whorls without the nucleus, and is smooth, depressed and naticoid. The growth of the umbilicus has not been completed in the type and the unique specimen.

Dimensions: Length 14.5 mm., diameter 10.8 mm.

It is closely related to *T. perspectiva* (Conrad), but differs by its shorter aperture, the greater number of the longitudinal ribs and by the presence of the prominent flat suture.

KIRKWOOD: Millville (460–470 feet).

Miocene Distribution.—New Jersey only. Most closely related to *T. perspectiva* (Conrad) from the St. Mary's of Maryland.

Geological Range.—Miocene.

Collections.—U.S.N.M. (Type 498977).

Cymatosyrinx casula Pilsbry and Harbison

Plate 17, figs. 7, 8.

Cymatosyrinx casula Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 111, pl. 3, figs. 11, 12, 1933.

Known only from the type, an immature shell, collected by Miss Harbison from Shephards Pits in 1931.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12559).

Cymatosyrinx polycyma Pilsbry and Harbison

Plate 21, fig. 15.

Cymatosyrinx polycyma Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 110, pl. 3, fig. 7, 1933.

Known only from type lot obtained in 1931.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12593).

Cymatosyrinx pseudeburnea (Heilprin)

Plate 21, figs. 12, 13.

Pleurotoma pseudeburnea Heilprin, Proc. Acad. Nat. Sci. Phila., vol. 39, p. 404, 1887; Whitfield, U. S. Geol. Surv., Mon. 24, p. 114, pl. 21, figs. 8–12, 1894.

Cymatosyrinx pseudeburnea Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 111, pl. 3, figs. 4, 5, 1933.

Abundant at Shiloh. According to Pilsbry and Harbison (1933, p. 111), the specimen figured as *Drillia pseudeburnea* by Martin from the Miocene of Maryland is not this species.

KIRKWOOD: Shiloh, Jericho.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A. N. S. P. (Type 502); N.J.S.M.; U. S. N. M.; W.F.I.S.; Rutg.; Newk.

Cymatosyrinx whitfieldi (Martin)

Plate 21, fig. 14.

Drillia elegans (Emmons), Whitfield, U. S. Geol. Surv., Mon. 24, p. 115, pl. 21, figs. 2–4, 1894 (not *Pleurotoma elegans* Emmons).

Drillia whitfieldi Martin, Maryland Geol. Surv., Miocene, p. 157, pl. 42, fig. 10, 1904.

Cymatosyrinx whitfieldi Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 112, pl. 5, fig. 2, 1933.

Described from the Calvert formation of Maryland. The *D. elegans* of Whitfield was a misidentification of this species.

KIRKWOOD: Shiloh, Jericho, Sea Isle City (600-700 feet).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M. (Type); W.F.I.S.

Pleuroliria ultima Pilsbry and Harbison

Plate 21, fig. 11.

Pleuroliria ultima Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 109, pl. 5, fig. 3, 1933.

Rare; obtained from Shephard's marl pits by Mr. William Tullner, Jr., in 1931.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12569).

Pleuroliria ultima foxi Pilsbry and Harbison

Plate 21, fig. 10.

Pleuroliria ultima foxi Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 110, pl. 5, fig. 1, 1933.

"Spiral keels weaker than in *P. ultima*; anterior canal much longer. The outer lip is extensively broken away, so that internal lirae, if they existed, are not to be seen" (P. & H.).

Type from a lot collected by William J. Fox, Dr. H. G. Griffiths, and C. W. Johnson near Shiloh in 1895.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—W.F.I.S. (Type); A.M.N.H.

Glyphostoma subflexuosum (Whitfield)

Plate 21, fig. 19.

Drillia subflexuosa Whitfield, U. S. Geol. Surv., Mon. 24, p. 116, pl. 21, figs. 5-7, 1894.

Glyphostoma subflexuosa Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 112, pl. 3, fig. 6, 1933.

According to Pilsbry and Harbison this species lives in a higher latitude than any other *Glyphostoma* on record.

KIRKWOOD: Shiloh.

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M. (Type); W.F.I.S.

Kurtziella precerina Pilsbry and Harbison

Plate 21, figs. 16, 17.

Surcula parva (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 117, pl. 21, fig. 1, 1894 (not of Conrad).

Kurtziella precerina Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 113, pl. 3, figs. 13-14, 1933.

Closely related to the recent *Mangilia cerina* Kurtz and Stimpson. According to Pilsbry and Harbison, Whitfield's *Surcula parva* Conrad is apparently a broken specimen of this species.

KIRKWOOD: Shiloh, Ocean City (515 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12589).

***Terebra inornata* Whitfield**

Plate 21, figs. 31, 32.

Terebra inornata Whitfield, U. S. Geol. Surv., Mon. 24, p. 114, pl. 20, figs. 11-13, 1894; Dall, Proc. U. S. Nat. Mus., vol. 18, p. 35, 1895; Martin, Maryland Geol. Surv., Miocene, p. 144, pl. 40, figs. 12, 13, 1904.

Most of the representatives of this species found in New Jersey are largely corroded by the action of water so that the original surface is lost. Whitfield described the species from a well at Cape May, N. J., between the depth of 320 and 360 feet; these shells were associated with other St. Mary's species.

KIRKWOOD: Atlantic City (873-95 feet), Ocean City (730 feet), Sea Isle City (600-700 feet), Cape May Court House (520 feet), Cape May (320-360 feet).

Miocene Distribution.—Maryland (CHOPTANK, ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P.; N.J.S.M. (Type); C.M.C.H.

***Terebra curvilirata* Conrad**

Plate 21, figs. 29, 30.

Terebra curvilirata Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 327, 1843.

Terebra curvilineata (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 113, pl. 20, figs. 14-17, 1894 (in part).

Terebra curvilirata Martin, Maryland Geol. Surv., Miocene, p. 141, pl. 40, fig. 8, 1904.

Very rare. Close to *T. whitfieldi* Martin, but distinguished from it by its heavier and broader shell.

KIRKWOOD: Shiloh, Jericho, Bridgeton, Ocean City (515 feet), Avalon (depth?).

Miocene Distribution.—Maryland (ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M.; W.F.I.S.

***Terebra curvilineata calvertensis* Martin**

Plate 17, fig. 6.

Terebra curvilineata calvertensis Martin, Maryland Geol. Surv., Miocene, p. 141, pl. 60, figs. 6-7, 1904.

Close to *T. whitfieldi* Martin but easily distinguished by the fact that "the whorls are constricted about one-third of the way below the suture by a distinct groove above which the whorls are distinctly tuberculate." Known from New Jersey only by an immature specimen.

KIRKWOOD: Avalon (depth?).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P.

***Terebra whitfieldi* Martin**

Plate 21, figs. 26, 27, 28.

Terebra curvilineata (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 113, pl. 20, figs. 15-17, 1894 (in part).

Terebra curvilineata whitfieldi Martin, Maryland Geol. Surv., Miocene, p. 140, pl. 40, figs. 3, 4, 1904.

The species which Whitfield identified as *T. curvilineata* Conrad consisted of two different species here recognized as *T. curvilirata* Conrad and *T. whitfieldi* Martin. Both forms are rare.

KIRKWOOD: Jericho, Millville (305 feet), Sea Isle City (well), Cape May (depth?).

Miocene Distribution.—Maryland (CALVERT).

Geological Range.—Miocene.

Collections.—A.N.S.P.; U.S.N.M.

***Acteocina wetherilli* (Lea)**

Plate 21, fig. 21.

Acteon wetherilli Lea, Contrib. to Geol., p. 213, pl. 6, fig. 224, 1833.

Tornatina wetherilli Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 1, p. 15, 1890.

Acteocina wetherilli Mansfield, Fla. Geol. Surv., Bull. 15, p. 73, 1937.

Lea described this species from Deal, N. J., but was not sure of the exact locality. According to Mansfield this or a closely related species occurs in the Miocene of Florida. This species is tentatively referred to the New Jersey Miocene.

KIRKWOOD (?): Deal.

Miocene Distribution.—Florida (?).

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 14431).

***Acteon ovooides* Conrad**

Plate 21, fig. 23.

Acteon ovooides Conrad, Jour. Acad. Nat. Sci. Phila., vol. 6, p. 227, pl. 9, fig. 24, 1830; Martin, Maryland Geol. Surv., Miocene, p. 131, pl. 39, fig. 2, 1904.

The only New Jersey specimens were obtained by Mr. Tullner from the Sea Isle City well.

KIRKWOOD: Sea Isle City (600-700 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P.

***Acteon shilohensis* Whitfield**

Plate 21, figs. 24, 25.

Acteon punctostriatus (Adams), Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 1, p. 14, 1890 (in part; not of C. B. Adams).

Acteon shilohensis Whitfield, U. S. Geol. Surv., Mon. 24, p. 137, pl. 24, figs. 15-17, 1894; Martin, Maryland Geol. Surv., Miocene, p. 132, pl. 39, fig. 4, 1904.

Rare, the only New Jersey specimens being the type material. "It differs from *A. punctostriatus* in being larger, more slender, and in having a larger part of the surface covered with the revolving striae. The type of *A. shilohensis* has a strongly turreted spire and no punctae in the revolving striae. If this is constant it makes the species distinct" (Martin).

KIRKWOOD: Shiloh.

Miocene Distribution.—Maryland (CALVERT, ST. MARY'S).

Geological Range.—Miocene.

Collections.—U.S.N.M. (Type).

Volvula iota (Conrad)

Plate 21, fig. 22.

Bulla accuminata Conrad, Jour. Acad. Nat. Sci. Phila., vol. 6, p. 210, 1830 (not *Volvula accuminata* Sowerby).

Ovula iota Conrad, Proc. Acad. Nat. Sci. Phila., vol. 1, p. 309, 1843.

Volvula iota Martin, Maryland Geol. Surv., Miocene, p. 134, pl. 39, figs. 6-9, 1904.

Not common; it is probable that a more complete set and better specimens would result in the recognition of the various varieties of *V. iota* described by Martin from the Miocene of Maryland.

KIRKWOOD: Shiloh, Cape May Court House (520 feet).

Miocene Distribution.—(*V. iota* and varieties) Maryland (CALVERT, CHOPTANK, ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P.; W.F.I.S.

SCAPHOPODA

Cadulus conradi Pilsbry and Harbison

Plate 22, figs. 18, 19.

Cadulus conradi Pilsbry and Harbison, Proc. Acad. Nat. Sci. Phila., vol. 85, p. 117, pl. 4, figs. 18, 19, 1933.

Fairly common at Shephard's pit.

KIRKWOOD: Shiloh, Ocean City (730 feet), Cape May Court House (520 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 12596B); C.M.C.H.

Dentalium caduloide Dall

Plate 22, fig. 20.

Dentalium caduloide Dall, Trans. Wagner Free Inst. Sci., vol. 3, pt. 2, p. 442, pl. 23, fig. 25, 1892.

Rare.

KIRKWOOD: Wildwood (752 feet), Cape May (980 feet).

Miocene Distribution.—Maryland (CALVERT, CHOPTANK, ST. MARY'S).

Geological Range.—Miocene.

Collections.—A.N.S.P.

CRUSTACEA

Balanus withersi Pilsbry

Plate 22, figs. 11-16.

Balanus proteus (Conrad), Whitfield, U. S. Geol. Surv., Mon. 24, p. 141, pl. 24, figs. 18-23, 1894 (not *Balanus proteus* Conrad).

Balanus withersi Pilsbry, Proc. Acad. Nat. Sci. Phila., vol. 82, pl. 36, figs. 1-27, 1931.

The scutae of this barnacle are very common in the marl pits on the Shephard farm at Shiloh and a few specimens have been found in wells. According to Pilsbry, this species is the probable ancestor of the recent *B. crenatus* Bruguiere.

KIRKWOOD: Shiloh, Atlantic City (depth?), Sea Isle City (600-700 feet), Cape May Court House (520 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 4727); N.J.S.M.; W.F.I.S.; C.M.C.H.; Rutg.; Newk.

Balanus shilohensis Pilsbry

Plate 22, figs. 6-10.

Balanus shilohensis Pilsbry, Proc. Acad. Nat. Sci. Phila., vol. 82, p. 431, pl. 37, figs. 1-24, 1931.

Rarer than *B. withersi* Pilsbry.

KIRKWOOD: Shiloh, Avalon (810 feet), Wildwood (920-1000 feet).

Miocene Distribution.—New Jersey only.

Geological Range.—Miocene.

Collections.—A.N.S.P. (Type 4728).

Balanus concavus proteus Conrad

Plate 22, fig. 17.

Balanus proteus Conrad, Jour. Acad. Nat. Sci. Phila., vol. 7, p. 134, 1834.

Balanus concavus proteus Pilsbry, U. S. Nat. Mus., Bull. 93, p. 103, pl. 22, figs. 3-3c, 1916.

One single individual was noted on a shell of *Ostrea virginica* collected by Leidy from Shiloh. This is not the *B. proteus* mentioned by Martin from the Miocene of Maryland. According to Pilsbry, the Maryland form should be referred to *B. concavus chesapeakeensis* Pilsbry. The Shiloh specimen resembles those from the Yorktown formation of Virginia.

KIRKWOOD: Shiloh.

Miocene Distribution.—Virginia (YORKTOWN), North Carolina.

Geological Range.—Miocene.

Collections.—A.N.S.P.

TABLE 1.—Distribution of Kirkwood Fauna in New Jersey.

	WELLS											MARYLAND					
	Shiloh-Jericho	Bridgeton-Fairton	Deal-Asbury Park	Quinton	Glassboro	Millville	Brigantine	Atlantic City	Ocean City	Sea Isle City	Avalon	Cape May C. H.	Wildwood	Cape May	Calvert	Choptank	St. Mary's
COELENTERATA																	
1. <i>Astrangia danae</i> Agassiz				×						600-700					?	?	?
2. ? <i>Astrangia marylandica</i> (Conrad)...										600-700							×
3. ? <i>Flabellum cuneiformis</i> wailesi Conrad								1012					1200				
ECHINODERMATA																	
4. <i>Echinarachnius</i> sp.												520					
Brachiozoa																	
5. <i>Acanthodesia savarti</i> (Audouin) ...															×	×	×
Brachiozoa																	
6. <i>Disciniscia lugubris</i> (Conrad)	×	×					×								×	×	×
MOLLUSCA—PELECYPODA																	
7. <i>Nucula proxima</i> Say	×	×						×		600-700			920-1000	980	×	×	×
8. <i>Nucula sinaria</i> Dall	×	×													×	×	×
9. <i>Leda liciata</i> (Conrad)	×	×													×	×	×
10. <i>Leda liciata amydra</i> Dall	×	×													×	×	×
11. <i>Yoldia laevis</i> (Say)	×	×													×	×	×
12. <i>Area subrostrata</i> Conrad															×	×	×
13. ? <i>Area staminea</i> Say								×	×	×	×	×			×	×	×
14. ? <i>Area lienosa</i> Say								×	×	×	×	×			×	×	×
15. ? <i>Area idonea</i> Conrad								×	×	×	×	×			×	×	×
16. <i>Area centenaria</i> Conrad	×	×													×	×	
17. <i>Area marylandica</i> (Conrad)	×	×													×	×	
18. <i>Area millvillensis</i> new species															×	×	
19. <i>Glycymeris parilis</i> (Conrad)	×	×													×	×	×
20. <i>Modiola inflata</i> (Tuomey & Holmes)	×	×								600-700	×				×	×	×

TABLE I.—Continued

	Shiloh-Jericho	Br.-Fairton	Deal-Asbury P.	WELLS							MARYLAND						
				Quinton	Glassboro	Millville	Brigantine	A. City	O. City	S. I. City	Avalon	C. M. C. H.	Wildwood	Cape May	Calvert	Choptank	St. Mary's
46. <i>Diplodonta shilohensis</i> Dall	×	×														×	×
47. <i>Diplodonta acclinis</i> (Conrad)	×	×														×	×
48. <i>Phacoides anodonta</i> (Say)																×	×
49. <i>Phacoides prunus</i> Dall																×	×
50. <i>Phacoides crenulatus</i> (Conrad)	×					215			595		810	520	718-900		×	×	×
51. <i>Phacoides trisulcata whitfieldi</i> Dall						385		×			×		411-14840-1000	×			
52. <i>Chama congregata</i> Conrad	×	×													×		×
53. <i>Cardium patuxentium</i> Glenn	×	×															
54. <i>Cardium laqueatum</i> Conrad																	
55. <i>Macrocallista marylandica</i> (Conrad)						410		×				520		611-618	×		?
56. <i>Dosinia acetabulum</i> (Conrad)															×		×
57. <i>Clementia inoceriformis</i> (Wagner).	×											520			×		×
58. <i>Antigona staminea</i> (Conrad)	×														×		×
59. <i>Venus ducatelli</i> Conrad	×														×		
60. <i>Venus mercenaria</i> Linné						212, 255						520	411-14 611-18	411	×		
61. <i>Venus submercenaria</i> Palmer	×														×		
62. <i>Venus plena</i> (Conrad)	×														×		
63. <i>Metis biplicata</i> (Conrad)						310									×		
64. <i>Ervilia</i> sp.																	
65. <i>Mulinia lateralis</i> (Say)	×					385		×		785							
66. <i>Macra delumbis</i> Conrad						×		936-941		600-700			800-900		×		×
67. <i>Macra clathrodon</i> Lea	×		×						385	600-700	800-815	520	411-14 840-1000	600-640	×		×

TABLE 1.—Continued

	WELLS										MARYLAND						
	Shiloh-Jericho	Br.-Fairton	Deal-Asbury P.	Quinton	Glassboro	Millville	Brigantine	A. City	O. City	S. I. City	Avalon	C. M. C. H.	Wildwood	Cape May	Calvert	Choptank	St. Mary's
68. <i>Macra insulaemaris</i> P. & H.										600-700							
69. <i>Donax abseconi</i> new species										600-700							
70. <i>Corbula elevata</i> Conrad	×							×		600-700	×				×		
71. <i>Corbula idonea</i> Conrad								×		600-700				×			
72. <i>Corbula inaequalis</i> Say	×	×						385		600-700							
73. <i>Corbula ima</i> P. & H.																	
74. <i>Semele burnsi</i> (Whitfield)	×																
75. <i>Semele johnsoniana</i> P. & H.	×																
76. <i>Tellina peracuta</i> Conrad	×												752				
77. <i>Tellina capillifera</i> Conrad	×																
78. <i>Tellina declivis</i> Say	×							×									
79. <i>Tellina producta</i> Conrad	×								595			520			×		
80. <i>Ensis directus</i> Conrad	×														×		
81. <i>Panopea whitfieldi</i> Dall	×														×		
82. <i>Saxicava myaeformis</i> Conrad	×														×		
83. <i>Saxicava parilis</i> Conrad	×														×		
84. <i>Saxicava arctica bilineata</i> Conrad ..	×	×													×		
85. <i>Mya producta</i> Conrad	×																
86. <i>Periploma peralta</i> Conrad	×																
MOLLUSCA—AMPHINEURA																	
87. <i>Chaetopleura apiculata</i> (Say)	×									600-700					×		
MOLLUSCA—GASTROPODA																	
88. <i>Fissuridea griseoni</i> (Conrad)	×	×							730						×	×	
89. <i>Calliostoma eborum</i> (Conrad) ...	×													420-460	×	×	
90. <i>Calliostoma tullneri</i> P. & H.										600-700							
91. <i>Turritella cumberlandia</i> Conrad ...	×	×						936-941	595	600-700	×	520	718-32 887-930		×		

TABLE 1.—Continued

	WELLS										MARYLAND						
	Shiloh-Jericho	Br.-Fairton	Deal-Asbury P.	Quinton	Glassboro	Millville	Brigantine	A. City	O. City	S. I. City	Avalon	C. M. C. H.	Wildwood	Cape May	Calvert	Choptank	St. Mary's
92. <i>Turritella acquistriata</i> Conrad	×								385	600-700			887-930	1010	×	×	×
93. <i>Turritella plebia</i> Say	×							450	515-730		×			×	×	×	×
94. <i>Turritella secta</i> Conrad	?				×			×					920-1000				
95. <i>Solarium trilineatum</i> Conrad							625-651					520			×		×
96. <i>Vermetus graniferus</i> (Say)	×									600-700					×	×	×
97. <i>Melanella retrocita</i> P. & H.	×									600-700							
98. <i>Cerithidea insulhemaris</i> P. & H.	×							730							×	×	
99. <i>Scila clavulus</i> (Lea)	×											520		×	×	×	×
100. <i>Triphora terebrata</i> Heilprin	×														×	×	
101. <i>Scalaria marylandica</i> (Martin)	×														×	×	
102. <i>Turbonilla interrupta</i> Totten	×														×	×	
103. <i>Fossarus lyra</i> (Conrad)	×																
104. <i>Fossarus dalli</i> (Whitfield)	×																
105. <i>Calyptrea aperta</i> (Solander)	×	×			500-520			873-941	730		810	520		×	×	×	×
106. <i>Crepidula formicata</i> (Linné)	?	?			430							520			×	×	×
107. <i>Crepidula plana</i> Say															×	×	
108. <i>Crucibulum costatum</i> (Say)		×			×						×			×	×	×	×
109. <i>Xenophora conchyliophora</i> (Born) ..	?														×	×	×
110. <i>Polinices heros</i> (Say)	×							×							×	×	×
111. <i>Polinices triseriata</i> (Say)						×											
112. <i>Polinices duplicata</i> (Say)	×				×	×		873-895	595.730		×	520			×	×	×
113. <i>Polinices hemicrypta</i> (Gabb)	×				470					600-700	×				×	×	
114. <i>Polinices tuomevi</i> (Whitfield)	×									?		520			×	×	×
115. <i>Sinum fragile</i> (Conrad)	×																
116. <i>Erato perexigua</i> (Conrad)	×																
117. <i>Ephora tricostrata</i> Martin					×					600-700						×	×

	WELLS				MARYLAND			
	Shiloh-Jericho	Br.-Raiton	Deal-Asbury P.	Quinton	Glasboro	Millville	Brigantine	A. City
								O. City
								S. I. City
								Avalon
								C. M. C. H.
								Wildwood
								Cape May
								Calvert
								Choptank
								St. Mary's
118. <i>Rapana ecclesiastica</i> Dall	×							600— 700
119. <i>Muricea shilohensis</i> (Heilprin) ..	×							600— 700
120. <i>Muricea burnsi</i> (Whitfield)	×							700
121. <i>Murex millvillensis</i> new species ...								
122. <i>Coralliophila cumberlandiana</i> (Gabb)	×							600— 700
123. <i>Mitrella communis</i> medioeris P. & H.	×							730
124. <i>Mitrella laevis</i> (Whitfield)	×							600— 700
125. <i>Siphonalia devexa</i> (Conrad)	×							515
126. <i>Busycon scalarispira</i> Conrad	×							600— 700
127. <i>Busycon tuberculatum</i> (Conrad) ..	×							600— 700
128. <i>Nassarius trivittatoides</i> (Whitfield)	×							520
129. <i>Nassarius trivittatoides</i> elongata (Whitfield)	×							815
130. <i>Nassarius bidentata</i> (Emmons) ...	×							520
131. <i>Nassarius sopora</i> (P. & H.)	×							1010
132. <i>Bulliopsis integra</i> (Conrad)	×							420— 460, 1010
133. <i>Fasciolaria woodi</i> Gabb	×							611— 618
134. <i>Oliva sayana</i> Ravenel	×							320—50, 456
135. <i>Cancellaria alternata</i> Conrad	×							840— 860
136. <i>Cancellaria shilohensis</i> P. & H. ...	×							×
137. <i>Cancellaria reticulatoides</i> Martin ..	×							×
138. <i>Trigonostoma beatum</i> P. & H.	×							×

ANALYSIS OF THE FAUNA

The Fauna as a Whole

Three species of corals, one bryozoon, one brachiopod, one echinoderm, three barnacles and 151 mollusks—a total of 160 species, have been reported from the Kirkwood formation of New Jersey. Of these, the following 4 are described as new species:

*Arca millvillensis**Murex millvillensis**Donax abseconi**Trigonostoma planasuturata*

In addition, the following 35 species previously described are known only from the Kirkwood of New Jersey, making a total of 39 species and varieties restricted to the formation:

Plicatula inornata (Whitfield)*Cancellaria shilohensis* P. & H.*Pecten humphreysii woolmani**Trigonostoma beatum* P. & H.

Heilprin

Cymatosyrinx casula P. & H.*Astarte distans* Conrad*Cymatosyrinx polycyma* P. & H.*Crassinella profundorum* P. & H.*Cymatosyrinx pseudeburnea* (Heilprin)*Venus submercenaria* Palmer*Glyphostoma subflexuosum* (Whitfield)*Mactra insulaemaris* P. & H.*Corbula ima* P. & H.*Kurtziella precerina* P. & H.*Semele johnsoniana* P. & H.*Triphora terebrata* Heilprin*Tellina peracuta* Conrad*Cerithidea insulaemaris* P. & H.*Tellina capilifera* Conrad*Pleuroliria ultima* P. & H.*Saxicava myaeformis* Conrad*Pleuroliria ultima foxi* P. & H.*Saxicava parilis* Conrad*Acteon shilohensis* Whitfield*Calliostoma tullneri* P. & H.? *Acteocina wetherilli* (Lea)*Turritella secta* Conrad*Cadulus conradi* P. & H.*Melanella retrocita* P. & H.*Mitrella communis mediocris* P. & H.*Busycon scalarispira* Conrad*Balanus withersi* Pilsbry*Nassarius sopora* (P. & H.)*Balanus shilohensis* Pilsbry*Fasciolaria woodi* Gabb

In addition to the fossils in the foregoing list which are restricted to the Kirkwood, the following species may for all practical purposes also be regarded as index fossils since they are much more abundant in the Kirkwood than in the Miocene deposits of Maryland or elsewhere:

Eucrassatella melina (Conrad)*Turritella cumberlandia* Conrad*Turritella aequistriata* Conrad

It seems significant that the great majority of the 160 Kirkwood species are restricted to Miocene deposits, many of them to the Chesapeake Group. Specifically, 123 species, or 77 percent, are known only from the Miocene; 35 species, or 22 percent, range upward into the Pliocene (mostly the Croatan or Waccamaw of the Carolinas or the Caloosahatchie of Florida); still fewer, 22 species, or 14 percent, reach the Pleistocene or Recent. Only 3 species also occur below the Miocene in the Eocene and of these, *Xenophora conchyliophora* (Born) ranges from the Cretaceous to the Recent. The relatively large stratigraphic break between the marine deposits of the Lower Miocene and those of the Eocene along the Middle Atlantic Coast may explain the lack of Eocene species.

Correlation with the Chesapeake Group of Maryland

The Chesapeake Group of Maryland is of middle Miocene age and in ascending order consists of the Calvert, Choptank and St. Mary's formations. Although Shattuck stated that there was an unconformity between the Calvert and the Choptank, the later work of Miss Schoonover has failed to recognize any break between the two formations. Furthermore, the Choptank fauna is very closely related to that of the Calvert, and it seems highly probable that the Choptank is merely a sandy phase of the Calvert that does not occur as a unit north in New Jersey or far south of the Maryland-Virginia line. For convenience in the present analysis the faunas of the Calvert and Choptank will be regarded as one. There is a definite unconformity between the Calvert or Choptank and the St. Mary's. A still later formation of the Chesapeake Group—the Yorktown—is known from Virginia and North Carolina, but is not known north of the Potomac River. (See Figure 9.)

Table 1 shows the distribution of the various Kirkwood species in New Jersey as well as in Maryland. Further data on the geographical distribution as well as the geological range will be found under the discussion of the various species.

In order to determine the exact relationship of the various elements of the Kirkwood formation, the fauna of each important New Jersey locality will be briefly analyzed.

Surface Localities

Shiloh-Jericho. Of the 111 species obtained from the marl pits, 32 are known only from New Jersey, while the remainder are much more characteristic of the Calvert than of any other Miocene formation.

Bridgeton-Fairton. This small fauna is very similar to that from Shiloh and shows Calvert affinities.

Subsurface Localities

Millville. Many of the species have no depth indicated; however, the presence of *Ensis directus* Conrad at 285 feet and *Busycon tuberculatum* (depth unknown) may indicate a thin layer of St. Mary's overlying the Calvert. Calvert species predominate between 460 and 520 feet. Inasmuch as three new species were described from this well, there may not be an exact correlation with the rest of the New Jersey Miocene.

Atlantic City. Most of the specimens have no depth indicated, although there are a few definite records between 555 and 941 feet. Seven species are known only from New Jersey, six are diagnostic of the Calvert and two (*Arca idonea* Conrad and *Terebra inornata* Whitfield) are suggestive of the St. Mary's.

Ocean City. The majority of the species show Calvert affinities, although *T. inornata* at 730 feet and *E. directus* at 595 feet may suggest a thin layer of St. Mary's overlying the Calvert.

Sea Isle City. The only records are below 700 feet and the closest relationship is with the Calvert. No index St. Mary's species were recorded.

Cape May Court House. All known fossils are from 520 feet. One species is known only from the New Jersey Miocene, two are characteristic of the Calvert and two of the St. Mary's.

Wildwood. The majority of the species are typical of the Calvert, although the presence of *Bulliopsis integra* (Conrad) at 611 feet may suggest an overlying St. Mary's.

Cape May. St. Mary's species (*B. integra*, *T. inornata*, etc.) are known from higher levels (320-456 feet), while characteristic Calvert species extend to at least 1100 feet.

SUBSURFACE STRATIGRAPHY OF THE MIOCENE OF NEW JERSEY

From a careful study of the numerous well samples at his disposal, Woolman made several attempts to work out the various phases of the subsurface stratigraphy of New Jersey. A large portion of Woolman's conclusions were based upon a study of the diatoms. Since at the time of Woolman's work, the subdivisions of the Chesapeake Group were not yet defined, and since many of the samples have been subjected to further study, it has been thought desirable to review his conclusions in the light of recent knowledge.

Section between Asbury Park and Cape May

Figure 5 is a geologic section drawn on the basis of information obtained from a series of wells along the coast of the Atlantic Ocean from Asbury Park, N. J., to Cape May, N. J., and Lewes, Del. The correlations are

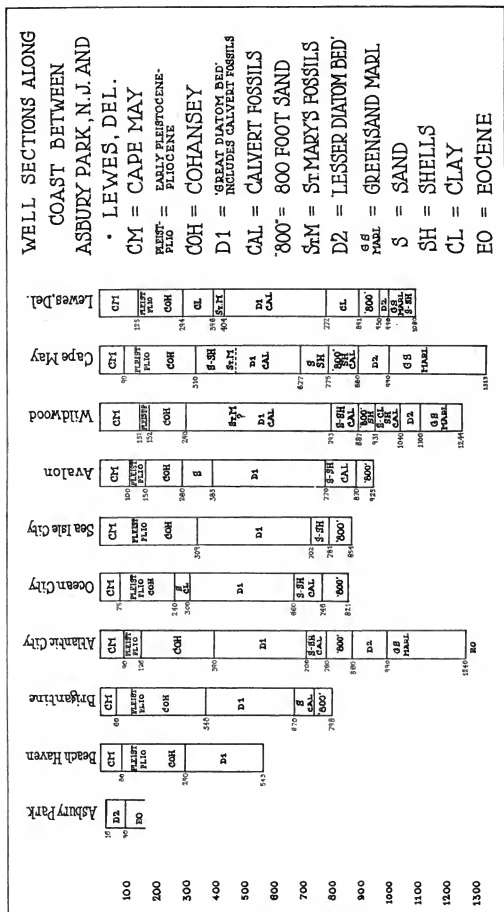


FIG. 5.—Well logs along coast from Asbury Park, N. J., to Cape May, N. J., and Lewes, Del.

largely those of Woolman although in many cases they have been redefined in the light of recent terminology.

Figure 6 is a diagrammatic section based upon the same well records.

A study of these sections shows that several distinct zones may be defined as follows:

(a) A layer of sand with marine shells and diatoms which usually extends down to 50 or 75 feet below the surface, although a thickening to 180 feet is noted in the vicinity of Delaware Bay. This is probably the Cape May formation of Pleistocene age, which was discussed in an earlier paper.³⁵

(b) Beneath the Cape May formation is a deposit of non-fossiliferous sand and clay thought to represent the early Pleistocene and possibly part of the Pliocene. These deposits apparently thicken toward the south although the contact with the next lowest phase is difficult to determine.

(c) Below this occur layers of sand and fine gravel, usually yellow or orange in color in which pieces of fossil wood are frequent. In the Atlantic City well — samples from which were carefully studied — this zone occurs between the depths of 126 and 390 feet. Because of their lithologic nature and its stratigraphic position, these sands are thought to be equivalent to the Cohansey formation of late Miocene or early Pliocene age. The presence of the fossil wood, partly lignitized, favors this correlation, since similar wood is frequent in the Cohansey formation.

(d) South of Atlantic City, wells show a fossiliferous sand with characteristic St. Mary's fossils on top of the "Great Diatom Bed." Such fossils were particularly noted in the Wildwood and Cape May wells where they occurred between the depths of 400 and 450 feet. *Terebra inornata* Whitfield and *Bulliopsis integra* (Conrad) are the most significant of these species. Characteristic St. Mary's fossils are not common in the Atlantic City well and it is thought probable that this phase of the St. Mary's formation pinches out somewhere near Atlantic City.

(e) The most definite zone recognized by Woolman was the "Great Diatom Bed" which extends from an outcrop near Asbury Park and dips downward to the south where it occurs at Cape May between the depths of 367 and 677 feet. In addition to dipping downward toward the south the thickness greatly increases in that direction.

In addition to the diatoms, fossil mollusks are numerous. The great majority of the species correlate with the Calvert of Maryland or with the outcrops of the Kirkwood near Shiloh, N. J. In the vicinity of Cape May and Wildwood, however, it is difficult to separate the top of the "Great Diatom Bed" from the St. Mary's on the basis of the fauna. On the other

³⁵ Paul MacClintock and H. G. Richards, Correlation of Late Pleistocene Marine and Glacial Deposits of New Jersey and New York. Bull. Geol. Soc. Amer., vol. 47, pp. 311-312, 1936.

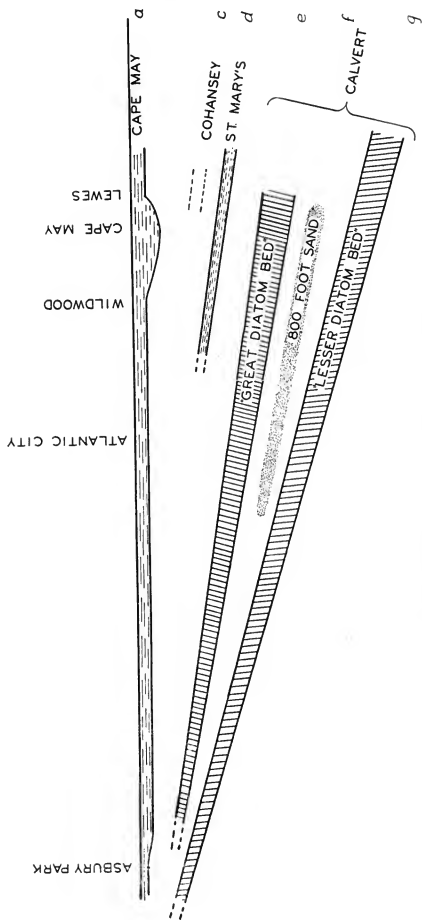


FIG. 6.—Diagrammatic section, Asbury Park, N. J., to Kirkwood, N. J.

hand those species most characteristic of Shiloh are found near the base of the "Great Diatom Bed" or possibly in the sand below it (such as *Melina maxillata*, *Astarte distans*, *Turritella cumberlandia*, *T. acquistriata*, etc.). As pointed out earlier in this paper the "Shiloh Marl" is regarded as Lower Kirkwood. Taking everything into consideration, it seems preferable to correlate the "Great Diatom Bed" with the Calvert, probably in large part stratigraphically higher than the "Shiloh Marl." The difficulty of separating the top of the Calvert from the St. Mary's may indicate that the sea did not retreat farther than the present shoreline in the interval between Calvert and St. Mary's time. How much of the "Great Diatom Bed" should be correlated with the Choptank can not be determined because of the lack of diagnostic Choptank fossils. It should be pointed out, however, that an exact correlation between the fossils from the deep wells along the coast and those from the outcrops of the Chesapeake formations farther inland should not be expected, because much of the well material must have been laid down in deeper water than the deposits along the outcrop. This may explain the presence of so many "new species" in the wells at Sea Isle City and elsewhere.

(f) Beneath the "Great Diatom Bed" and sometimes separated from it by a layer of sand carrying characteristic Shiloh fossils, is the so-called "800 foot sand," one of the most important water-bearing strata of the New Jersey coast. It was so named because it occurs between the depths of 760 and 840 feet at Atlantic City where it is the source of much of the city's water. It has definitely been traced along the coast north to Brigantine and south to Wildwood. At Cape May, the equivalent of the "800 foot sand" occurs between the depths of 775 and 850 feet, although the stratum is much more clayey than at Atlantic City. Shell fragments are present in some samples from this stratum in various wells, a fact which may indicate continuous marine deposition.

Not many wells go below the "800 foot sand" and correlations below this depth are less certain. A fossiliferous sand is known to occur between the "Great Diatom Bed" and the "Lesser Diatom Bed" in wells at Atlantic City, Wildwood, Cape May, and Lewes. The fossils are characteristically Calvert.

(g) The "Lesser Diatom Bed" is known only from wells at Atlantic City (860-990 feet), Wildwood (1040-1100), Cape May (880-990), and Lewes (910-990). It is characterized by the presence of the diatom *Actinoptychus heliopelta* which is diagnostic of the basal Calvert of Maryland. The same diatom occurs in the clay pits at Whitesville (near Asbury Park) and at Shiloh. This evidence favors dating the "Lesser Diatom Bed" as basal Calvert.

(h) Greensand marl and sand carrying Miocene fossils are known to lie beneath the "Lesser Diatom Bed" at both Atlantic City and Cape May.

The only identifiable fossil is *Venericardia granulata* Say, a species which is known in New Jersey only from deeper portions of wells. It is, however, widespread throughout the Chesapeake Miocene, and therefore cannot give any clue to the exact age of this stratum. A coral, provisionally identified by Dr. T. Wayland Vaughan as a Tertiary species of *Flabellum* "probably *F. cuneiformis* Lonsdale var. *wailesi* Conrad," was recorded by Woolman³⁶ from the depth of 1012 feet at Atlantic City and 1200 feet at Wildwood. Unfortunately the specimens are not available for further study.

This stratum may be still more basal Calvert, or possibly pre-Calvert and may be the equivalent of the Trent formation of North Carolina.

(i) The contact between the Miocene and the Eocene is not clearly indicated. It is thought to occur at 1240 feet at Atlantic City³⁷ and possibly at 1244 feet at Wildwood. At 1440 feet at Atlantic City characteristic Vincentown (Eocene) limesand was struck, so the contact must be above that depth. Dr. Stephen Fox of Princeton University has recognized some characteristic Eocene species of foraminifera in samples from the Atlantic City well taken between the depths of 1430 and 1450 feet.

(j) In the deepest well at Atlantic City the Vincentown limesand extended to the depth of 1900 feet, below which there was greensand marl and clay of "pre-Vincentown age." This extended to the bottom of the well at 2306 feet.

Geologic Section between Atlantic City and Kirkwood

Less is known about this section and therefore Figure 7 is highly diagrammatic. The "Great Diatom Bed" is known to occur at Egg Harbor between the depths of 164 and 310 feet, but is not reported farther west. The "Lesser Diatom Bed" has not been struck in any wells back from the coast, although theoretically it should reach the surface in the vicinity of Kirkwood in Camden County since the characteristic diatom *A. heliopelta* occurs in this bed and also at the surface along the strike of the formation at Shiloh and Whitesville.

In this connection, Thompson,³⁸ regarded the sediments in the Atlantic City well between 390 and 931 feet—in other words down to and including the 800 foot sand—as Kirkwood, and those from 931 feet to the top of the Eocene as "Pre-Kirkwood." It would seem preferable, however, to extend the term Kirkwood to include the "Lesser Diatom Bed" inasmuch as this bed seems equivalent to the outcrop at the type locality.

³⁶ Lewis Woolman, Ann. Rept. of N. J. State Geol. for 1901, p. 115.

³⁷ David Thompson. Ground Water Supply of the Atlantic City Region. N. J. Dept. Conservation and Development, Bull. 30, p. 28, 1928.

³⁸ David Thompson, *op. cit.*, p. 28, 1928.

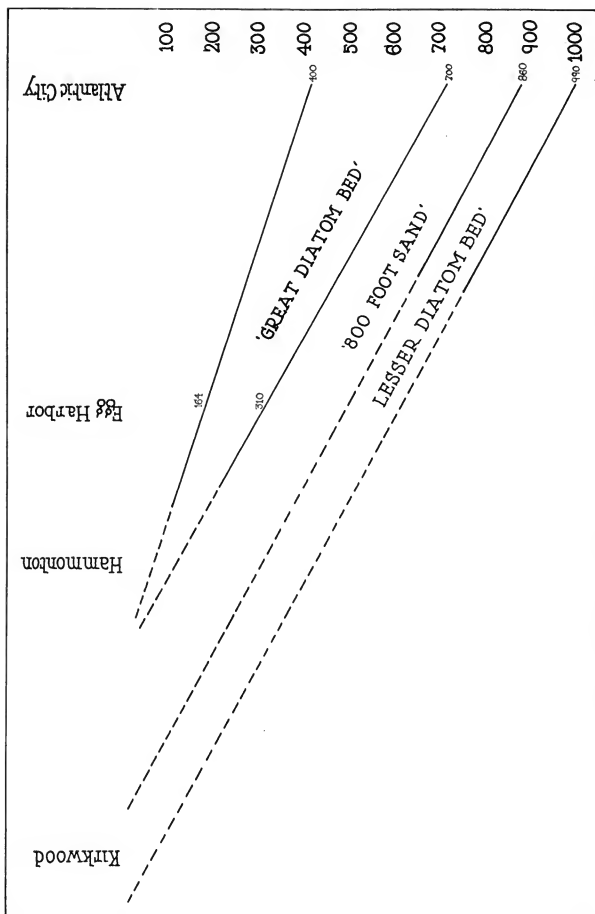


FIG. 7.—Diagrammatic section, Atlantic City, N. J., to Kirkwood, N. J.

Section between Ocean City and Quinton

The evidence upon which this section is based is less clear. The diatom beds have not been recognized and stratigraphic divisions are based on lithology and macrofossils.

In the Millville well, it is apparent that the characteristic St. Mary's fossils occur in the upper part (usually above 460 feet), while the Calvert fossils occur at greater depths and down to the base of the Miocene at 580 feet.

The St. Mary's phase apparently pinches out between Millville and Bridgeton, because the outcrop at Bridgeton contains characteristic Calvert fossils. In the vicinity of Cohansey Creek, the formation is consolidated into a sandstone or quartzite ("Cohansey Quartzite"). The "Shiloh Marl" with its Calvert fauna occurs close to the surface from Bridgeton through Shiloh, to the Delaware River. At Quinton, "Shiloh" fossils were encountered between the surface and 30 feet in a well.

Section between Shiloh and Asbury Park

This section follows the strike of the formation. (See Figure 1). As stated in the previous paragraph, fossiliferous Kirkwood occurs near the surface at Bridgeton, Shiloh, and Quinton. Woolman also recorded Miocene fossils from a well at Glassboro between the depths of 80 and 145 feet. The type locality of the formation is at Kirkwood, in Camden County, although no fossils have been found in that vicinity.

The next locality to the northeast where fossils occur is at Farmingdale, Monmouth County, where shells were reported by Clark.

Finally, diatoms have been found at Whitesville (Asbury Park) and shells were reported from nearby Deal. That the deposits along this section are of approximately the same age is suggested by the presence of the characteristic diatom *A. heliopelta* at Shiloh and Whitesville. In both cases, the deposits are Lower Kirkwood, and equivalent to the Calvert of Maryland.

CORRELATION WITH THE SOUTHERN MIOCENE

Although faunistically there may be several divisions of the Kirkwood formation of New Jersey, it does not seem wise at this time to separate it into different formations. As pointed out in the previous section, it is not easy to draw sharp lines between the phases, and there is a certain amount of evidence to show that marine deposition was continuous throughout Kirkwood time at least along the present coast of New Jersey. It does seem desirable, however, to recognize the existence of these various phases and Figure 8 is an attempt to show these based upon the discussion in the previous sections of this report.

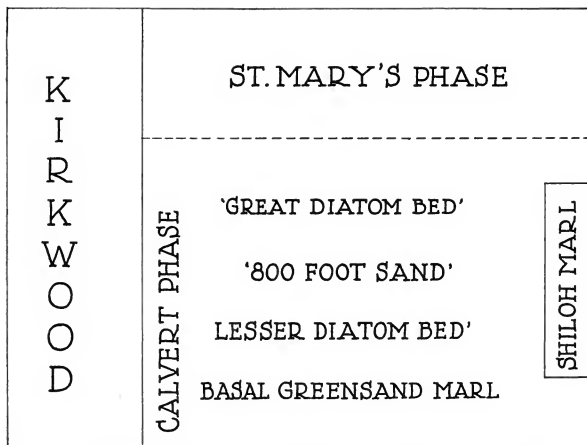


FIG. 8.—Suggested subdivisions of the Kirkwood formation of New Jersey.

Maryland. The correlation of the Kirkwood with the Chesapeake Group of Maryland has been mentioned several times. In that State the formations within this group have been subdivided into numerous zones or phases by Harris,³⁹ Shattuck,⁴⁰ and Schoonover,⁴¹ but since many of these are of local significance only, it does not seem possible to correlate them with the phases of the Kirkwood in New Jersey. A recent note on the Miocene of Maryland and Virginia was given by Stephenson and MacNeil.⁴²

Virginia. The Chesapeake Group extends into Virginia where a still higher formation—the Yorktown—is especially prominent. This is unknown farther north, although it is possible that the Cohansey formation of New Jersey may be an equivalent. According to Mansfield,⁴³ in

³⁹ G. D. Harris, *The Tertiary Geology, Calvert Cliffs, Maryland.* Amer. Jour. Sci., Ser. 3, vol. 45, pp. 21-31, 1893.

⁴⁰ G. B. Shattuck, et al., *Maryland Geol. Surv., Miocene*, 1904.

⁴¹ Lois Schoonover, *A Stratigraphic Study of the Mollusks of the Calvert and Choptank Formations of Southern Maryland.* Bulls. Amer. Paleont., vol. 25, no. 94B, 1941.

⁴² L. W. Stephenson and F. S. MacNeil, *Late Tertiary Marine Formation in North-eastern Tidewater Virginia and Southern Maryland.* Bull. Geol. Soc. Amer., vol. 49, p. 1959, 1938.

⁴³ W. C. Mansfield, *The Chesapeake Miocene Basin of Sedimentation as expressed in The New Geologic Map of Virginia.* Jour. Wash. Acad. Sci., vol. 19, pp. 263-268, 1929.

southern Virginia (near Richmond) the St. Mary's deposits overlap the Calvert while still farther south the Yorktown formation overlaps both the Calvert and St. Mary's and extends a few miles over the crystalline rocks of the Piedmont Plateau. This overlap was first pointed out by Olsson.⁴⁴ Various faunal zones have also been recognized in the Yorktown formation.

NEW JERSEY		DELAWARE-MARYLAND	VIRGINIA	NORTH CAROLINA
COHANSEY ????		ABSENT	YORKTOWN	DUPLIN- YORKTOWN
KIRKWOOD	St.MARY'S PHASE	ST.MARY'S	ST. MARY'S	ST.MARY'S (?)
	CALVERT PHASE	CHOPTANK	CALVERT	ABSENT
		CALVERT		
				TRENT

FIG. 9.—Correlation of Miocene formations from New Jersey to North Carolina.

North Carolina. No Calvert deposits are known south of the vicinity of Petersburg, Virginia.⁴⁵ The St. Mary's formation, originally mapped as covering a wide area in northeastern North Carolina, is now regarded as being extremely limited and overlain by the Yorktown formation. The fossiliferous deposits referred to the St. Mary's by Clark and Miller,⁴⁶ were placed in the "Murfreestboro Stage" by Olsson. This term was shown to be preoccupied and the "stage" was placed in the Yorktown formation by Mansfield.⁴⁷

The Yorktown formation is widespread in North Carolina; north of the Hatteras region it carries a fauna characteristic of fairly cool water. South of the Hatteras region the Yorktown formation correlates, approximately at least, with the Duplin Marl containing a warm-water fauna. This correlation may not be exact, but it is thought that the Duplin Marl is equivalent to the upper part of the Yorktown.

⁴⁴ Axel Olsson, The Murfreestboro Stage of our East Coast Miocene. *Bulls. Amer. Paleont.*, vol. 5, pp. 153-164, 1917.

⁴⁵ The deposits in the immediate vicinity of Petersburg, Va., are of Yorktown age. Personal communication from Dr. Julia Gardner.

⁴⁶ W. B. Clark and B. L. Miller, *North Carolina Geol. and Econ. Survey*, vol. 3, 1912.

⁴⁷ W. C. Mansfield, *op cit.*

Locally, especially in Onslow County, there are deposits of the Trent Marl, of Lower Miocene age, apparently pre-Calvert. A fauna from this formation was described by Kellum,⁴⁸ while additional records are discussed in a forthcoming paper by Richards.⁴⁹

Farther south. As discussed in the next section, (Geological History) it is believed that the vicinity of Cape Fear, N. C., the land remained high throughout the Miocene until the deposition of the Yorktown-Duplin formation. If this is so, there can be no direct correlation of pre-Yorktown formations north and south of the Cape Fear region, or "Carolina Ridge," as it has frequently been called. On the other hand, the Duplin Marl does extend continuously at least as far south as Georgia.

For further discussion of possible correlations between the Miocene formations north and south of the "Carolina Ridge" particularly with those of Florida, see Cooke.⁵⁰

Figure 9 is a correlation table of the Miocene formations between New Jersey and North Carolina.

GEOLOGICAL HISTORY OF THE MIOCENE

The following account attempts to give the main events that took place during the Miocene along the east coast of the United States, with especial reference to New Jersey. It has been necessary to extend these observations considerably to the south of that State because only by so doing can one understand the events that took place within its present limits. It has also been necessary to indicate briefly a few events that probably took place before and after the Miocene. The data upon which this section is based were obtained from numerous sources and "synthesized" into the present form. Probably the most useful sources have been the reports of Cooke, Mansfield, and Stephenson.

During the late Eocene (Jackson time) there is thought to have been a pronounced crustal movement that raised the region between Cape Fear River, N. C., and the Santee River, S. C. This elevated region has been called the "Carolina Ridge" and its former existence is clearly demonstrated by wells in the Wilmington, N. C., area where Cretaceous and basement rocks are very close to the surface; whereas both north and

⁴⁸ L. B. Kellum, *Paleontology of The Castle Hayne and Trent Marls in North Carolina*. U. S. Geol. Surv., Prof. Paper 143, 1926.

⁴⁹ H. G. Richards, in preparation.

⁵⁰ C. W. Cooke, *Geology of The Coastal Plain of South Carolina*. U. S. Geol. Surv., Bull. 867, p. 100, 1936.

south they dip considerably.⁵¹ The land on each side of the ridge was depressed and covered by the sea.

At the beginning of the Miocene, the "Carolina Ridge" together with the land both north and south were above water. The first invasion of the sea north of the "ridge" was relatively slight and appears only to have submerged a portion of eastern North Carolina, particularly in Onslow and Jones Counties. The sediments deposited by this sea are known as the Trent formation and are known best from marl pits near Silverdale, N. C. It is probable that the Trent sea had a counterpart south of the "Carolina Ridge," particularly in Florida where the Tampa limestone was deposited. The fossils of the Trent formation and Tampa limestone suggest contemporaneity. Possibly the Trent sea extended over the present land north of North Carolina but if so the deposits have since been eroded and it appears more likely that the invasion was more or less local. As far as can be learned from the fossils, the climate was relatively warm.

The next marine invasion of the land north of the "ridge" was in Calvert time. The shore-line probably extended across New Jersey from Asbury Park to about Salem, and then across Delaware, Maryland and Virginia to the vicinity of Petersburg, Va. The Calvert formation disappears near the Virginia-North Carolina line and it is probable that the depression of the land did not extend much farther south and that the shore-line turned abruptly toward the present coast. As shown by the contained fossils, the climate was warmer than that of the present time in the corresponding latitudes. In New Jersey this is indicated by the presence of such genera as *Chama*, *Plicatula*, *Glycymeris*, *Dosinia*, *Xenophora*, *Fasciolaria*, and *Sinum*.

During Calvert time the "Carolina Ridge" probably extended far out into the sea, for the nearest counterpart of the Calvert to the south is thought to be a part of the Alum Bluff Group of Florida.

The Choptank formation of Maryland was probably laid down at the close of Calvert time. Possibly there was a withdrawal of the sea and a readvance to form the Choptank formation, but it seems more likely that the Choptank merely represents a late, sandy phase of the Calvert, possibly formed during a retreating sea. As evidenced by the Choptank fossils, the water temperature was somewhat cooler.

There followed a period of uplift and erosion—at least north of the "ridge."

The next advance of the sea was in St. Mary's time. The maximum depression of the land was slightly farther south than during Calvert time

⁵¹ L. W. Stephenson, Major Features of the Geology of The Atlantic and Gulf Coastal Plains. Jour. Wash. Acad. Sci., vol. 16, p. 466, 1926.

W. C. Mansfield, Some Deep Wells in Virginia and the Carolinas. U. S. Geol. Surv., Prof. Paper 1861, 1937.

and the St. Mary's shoreline probably crossed New Jersey from somewhere near Atlantic City to Millville, and then crossed Delaware, Maryland and Virginia; but it never reached as far inland as the Calvert shoreline. Near Richmond, Va., the St. Mary's shoreline overlapped that of the Calvert and thus the maximum advance of the sea was somewhere near Richmond. The shoreline probably extended south into North Carolina, although the deposits are largely buried at the present time and evidence is lacking to determine this point. Just as in the case of the Calvert sea, the St. Mary's shoreline probably turned sharply toward the coast in central North Carolina and southern North Carolina, including the "Carolina Ridge" was probably above water. Farther south the lowest beds of the Choc-tawhatchee formation of Florida are apparently the counterpart of the St. Mary's formation and is evidence that the sea during St. Mary's time there also curved inland.

The climate during St. Mary's time was cooler than it had been during the Calvert. This is shown in New Jersey by the presence of such species as: *Ensis directus* Conrad, *Crepidula plana* Say, and *Anomia simplex* D'Orbigny.

The withdrawal of the St. Mary's sea was followed by further erosion. Then the land was depressed again and the Yorktown sea advanced. This sea did not extend as far north as New Jersey but crossed the present strand line somewhere not far north of Yorktown, Va. It overlapped the Calvert and St. Mary's shorelines near Richmond and extended a few miles over the Piedmont rocks; then extended south across the Coastal Plain of North Carolina. By this time the "Carolina Ridge" had submerged and consequently the sea was probably continuous from Virginia to Florida. South of the region of Cape Hatteras, at least, the climate was warm as shown by the fauna of the Duplin Marl which is probably a late phase of the Yorktown formation. Very extensive faunas have been found in the Duplin Marl at the Natural Well near Magnolia, N. C. and from marl pits near Mayesville, S. C.

New Jersey was above water during Yorktown time and consequently no marine fossils of this age are known from the State. It is possible that the Cohansey formation with its warm-climate flora may represent a phase of the Yorktown. It is also possible that the Cohansey is Pliocene although the paleobotanical evidence favors a Miocene dating.

Yorktown time was followed by another period of erosion and withdrawal of the sea. Apparently the next advance of the sea was at the beginning of the Pliocene when the Waccamaw sea covered the eastern portion of the Coastal Plain of the Carolinas and probably farther south. North of the vicinity of the Virginia-North Carolina line the land remained above sea-level and marine Pliocene deposits are not known.

EXPLANATION OF PLATES 7 TO 22

All figures natural size unless otherwise indicated.

PLATE 7.

- FIG. 1.—*Nucula proxima* Say, Jericho, N. J. A.N.S.P. 13994. ($\times 3$)
FIG. 2.—*Nucula sinaria* Dall, Shiloh, N. J. W.F.I.S. 6923. ($\times 2$)
FIG. 3.—*Leda liciata* (Conrad), Shiloh, N. J. A.N.S.P. 13982. ($\times 2$)
FIG. 4.—*Leda liciata amydra* Dall, Shiloh, N. J. A.N.S.P. 14094. ($\times 2$)
FIG. 5.—*Yoldia laevis* (Say), Shiloh, N. J. A.N.S.P. 14020.
FIG. 6.—*Yoldia laevis* (Say), Shiloh, N. J. W.F.I.S. 6924.
FIGS. 7, 8.—*Arca centenaria* Say, Shiloh, N. J. A.N.S.P. 13970.
FIGS. 9, 10.—*Arca marylandica* (Conrad), Jericho, N. J. U.S.N.M. 111618.
FIGS. 11, 12.—*Arca millvillensis* new species, (Type), Millville, N. J. U.S.N.M. 498976.
FIG. 13.—*Arca subrostrata* Conrad, Atlantic City, N. J. A.N.S.P. 13961.
FIG. 14.—*Arca staminea* Say, Atlantic City, N. J. A.N.S.P. 13957.
FIG. 15.—*Modiola inflata* (Tuomey and Holmes), Shiloh, N. J. A.N.S.P. 13987.
FIGS. 16, 17.—*Glycymeris parilis* (Conrad), Sea Isle City, N. J. A.N.S.P. 12524.
FIG. 18.—?*Mytilus incurvus* (Conrad), Jericho, N. J. U.S.N.M. 154376.

PLATE 8.

- FIG. 1.—*Melina mazillata* (Deshayes), Sea Isle City, N. J. A.N.S.P. 12538.
FIGS. 2, 3.—*Plicatula densata* Conrad, Shiloh, N. J. A.N.S.P. 14016.
FIG. 4.—*Pecten humphreysii* Conrad, New Jersey. N.J.S.M. 10371.
FIG. 5.—*Lithophaga subalveata* Conrad, Shiloh, N. J. W.F.I.S. 6936. ($\times 4$)
FIGS. 6, 7.—*Plicatula marginata* Say, Shiloh, N. J. W.F.I.S. 4627.
FIGS. 8, 9.—*Plicatula inornata* (Whitfield), (Type), Shiloh, N. J. U.S.N.M. 11622.
FIG. 10.—*Anomia simplex* D'Orbigny, Cape May Court House, N. J. A.N.S.P. 14000.
FIG. 11.—*Pecten madisonius* Say, Shiloh, N. J. N.J.S.M. 10374.
FIG. 12.—*Pecten humphreysii woolmani* Heilprin, Shiloh, N. J. A.N.S.P. 13993.
FIG. 13.—*Pecten humphreysii woolmani* Heilprin, Shiloh, N. J. N.J.S.M. 10373.

PLATE 9.

- FIG. 1.—*Ostrea percrassa* Conrad, Shiloh, N. J. A.N.S.P. 14024. ($\times \frac{1}{2}$)
FIG. 2.—*Pecten humphreysii woolmani* Heilprin, Shiloh, N. J. N.J.S.M. 10372.
($\times \frac{3}{8}$)
FIG. 3.—*Ostrea percrassa* Conrad, Shiloh, N. J. A.N.S.P. 14024. ($\times \frac{1}{2}$)
FIG. 4.—*Ostrea virginica* Gmelin, Shiloh, N. J. N.J.S.M. 7835. ($\times \frac{3}{8}$)

PLATE 10.

- FIGS. 1, 2.—*Astarte distans* Conrad, Shiloh, N. J. A.N.S.P. 13969.
FIGS. 3, 4.—*Astarte thomasi* Conrad, Shiloh, N. J. A.N.S.P. 13966.
FIGS. 5, 6.—*Astarte symmetrica* Conrad, Virginia. A.N.S.P. 13965.
FIGS. 7, 8.—*Astarte perplana* Conrad, Atlantic City, N. J. A.N.S.P. 13964.
FIGS. 9, 10.—*Astarte cuneiformis* Conrad, Plum Point, Md. A.N.S.P. 13963.
FIGS. 11, 12.—*Cardita arata* (Conrad), Shiloh, N. J. A.N.S.P. 14436.
FIG. 13.—*Macrocallista marylandica* (Conrad), Cape May Court House, N. J. C.M.C.H.
FIGS. 14, 15.—*Eurassatella melina* (Conrad), Shiloh, N. J. N.J.S.M. 10384.

PLATE 11.

- FIGS. 1, 2.—*Venericardia granulata* Say, Atlantic City, N. J. A.N.S.P. 14021.
 FIG. 3.—*Diplodonta shilohensis* Dall, Shiloh, N. J. A.N.S.P. 13971.
 FIG. 4.—*Diplodonta shilohensis* Dall, Jericho, N. J. U.S.N.M. 111614.
 FIG. 5.—*Sportella whitfieldi* Dall, Shiloh, N. J. W.F.I.S. 6908. ($\times 2$)
 FIGS. 6, 7.—*Phacoides trisulcata whitfieldi* Dall, Atlantic City, N. J. A.N.S.P. 14017. ($\times 5$)
 FIG. 8.—*Diplodonta acclinis* (Conrad), Greensboro, Md. U.S.N.M. 143611.
 FIG. 9.—*Diplodonta acclinis* (Conrad), Jericho, N. J. U.S.N.M. 111614.
 FIG. 10.—*Diplodonta acclinis* (Conrad), Greensboro, Md. U.S.N.M. 143611.
 FIGS. 11, 12.—*Phacoides cremulatus* (Conrad), Shiloh, N. J. A.N.S.P. 14009. ($\times 5$)
 FIGS. 13, 14.—*Phacoides prunus* Dall, Shiloh, N. J. A.N.S.P. 14018.
 FIGS. 15, 16.—*Phacoides anodonta* (Say), Sea Isle City, N. J. A.N.S.P. 12546.

PLATE 12.

- FIG. 1.—*Dosinia acetabulum* (Conrad), St. Mary's, Md. A.N.S.P. 601.
 FIGS. 2, 3.—*Metis buplicata* (Conrad), Millville, N. J. U.S.N.M. 559152.
 FIG. 4.—*Cardium patuxentium* Glenn, New Jersey. N.J.S.M. 10389.
 FIG. 5.—*Dosinia acetabulum* (Conrad), Atlantic City, N. J. A.N.S.P. 14433.
 FIG. 6.—*Cardium laqueatum* Conrad, Sea Isle City, N. J. A.N.S.P. 12548.
 FIGS. 7, 8.—*Antigona staminea* (Conrad), Sea Isle City, N. J. N.J.S.M. 10388.
 FIGS. 9, 10.—*Astarte* sp., Atlantic City, N. J. A.N.S.P.
 FIGS. 11, 12.—*Ervillia* sp., Sea Isle City, N. J. U.S.N.M. ($\times 5$)
 FIG. 13.—*Chama congregata* Conrad, Shiloh, N. J. N.J.S.M. 10379.

PLATE 13.

- FIGS. 1, 2.—*Venus plena* (Conrad), "New Jersey." A.N.S.P. 14019.
 FIGS. 3, 4.—*Venus mercenaria* Linné, Shiloh, N. J. W.F.I.S. 6910.
 FIG. 5.—*Venus ducatelli* Conrad, Sea Isle City, N. J. A.N.S.P. 12550.
 FIG. 6.—*Venus submercenaria* Palmer, (Type), Shiloh, N. J. A.N.S.P. 4137.

PLATE 14.

- FIG. 1.—*Panopea whitfieldi* Dall, Shiloh, N. J. W.F.I.S. 6929. ($\times \frac{1}{2}$)
 FIG. 2.—*Arca idonea* Conrad, St. Mary's River, Md. A.N.S.P. 1022. ($\times \frac{1}{2}$)
 FIGS. 3, 4.—*Arca lienosa* Say, Cape Fear River, N. C. A.N.S.P. 13959. ($\times \frac{1}{2}$)
 FIGS. 5, 6.—*Arca subrostrata* Conrad, Maryland. A.N.S.P. 13962. ($\times \frac{1}{2}$)
 FIGS. 7, 8.—*Panopea whitfieldi* Dall, Shiloh, N. J. U.S.N.M. 2106. ($\times \frac{1}{2}$)

PLATE 15.

- FIG. 1.—*Macra clathrodon* Lea, Sea Isle City, N. J. A.N.S.P. 12555.
 FIGS. 2, 3.—*Mulinia lateralis* (Say), Atlantic City, N. J. A.N.S.P. 13996.
 FIG. 4.—*Mulinia lateralis* (Say), Millville, N. J. U.S.N.M. 559153.
 FIGS. 5, 6.—*Donax abseconi* new species, (Type), Atlantic City, N. J. A.N.S.P. 13984.
 FIG. 7.—*Corbula idonea* Conrad, Atlantic City, N. J. A.N.S.P. 13973.
 FIG. 8.—*Mulinia lateralis* Say, Millville, N. J. U.S.N.M. 559153.
 FIGS. 9, 10.—*Corbula elevata* Conrad, Shiloh, N. J. A.N.S.P. 14095. ($\times 2$)
 FIGS. 11, 12.—*Semele johnsoniana* P. & H., Shiloh, N. J. W.F.I.S. 6909. ($\times 1\frac{1}{2}$)
 FIGS. 13, 14.—*Corbula inaequalis* Say, Shiloh, N. J. A.N.S.P. 14008. ($\times 3$)

- FIG. 15.—*Corbula idonea* Conrad, Patuxent River, Md. A.N.S.P. 13972.
 FIGS. 16, 17.—*Macraa dehumbis* Conrad, Millville, N. J. U.S.N.M. 559151.
 FIG. 18.—*Semele burnsi* (Whitfield), Jericho, N. J. U.S.N.M. 111588. (× 2.)
 FIG. 19.—*Semele burnsi* (Whitfield), Jericho, N. J. U.S.N.M. 111587. (× 2.)
 FIG. 20.—*Mulinia lateralis* (Say), Jericho, N. J. U.S.N.M. 111586. (× 2.)

PLATE 16.

- FIG. 1.—*Tellina capilifera* Conrad, Shiloh, N. J. A.N.S.P. 14012.
 FIG. 2.—*Tellina declivis* Say, Atlantic City, N. J. A.N.S.P. 14010.
 FIGS. 3, 4.—*Tellina declivis* Say, Virginia. A.N.S.P. 4306.
 FIGS. 5, 6.—*Tellina producta* Conrad, Atlantic City, N. J. A.N.S.P. 14011. (× 2.)
 FIGS. 7, 8.—*Ensis directus* Conrad, Millville, N. J. U.S.N.M. 559157.
 FIG. 9.—*Saxicava myaeformis* Conrad, (Type), Shiloh, N. J. A.N.S.P. 14014.
 FIG. 10.—*Saxicava parilis* Conrad, (Type), Shiloh, N. J. A.N.S.P. 14013.
 FIG. 11.—*Mya producta* Conrad, Shiloh, N. J. A.N.S.P. 13995. (× 5.)
 FIG. 12.—*Mya producta* Conrad, Patuxent River, Md. A.N.S.P. 14026.
 FIGS. 13, 14.—*Saxicava arctica bilineata* Conrad, Shiloh, N. J. W.F.I.S. 6914. (× 4.)

PLATE 17.

- FIG. 1.—*Venus submercenaria* Palmer, (Type), Shiloh, N. J. A.N.S.P. 4137.
 FIG. 2.—*Periploma peralta* Conrad, (Type), Shiloh, N. J. A.N.S.P. 13989.
 FIG. 3.—*Pecten gibbus* (Linné), Millville, N. J. U.S.N.M. 499149.
 FIG. 4.—*Anomia simplex* D'Orbigny, Cape May Court House, N. J. A.N.S.P. 14000.
 FIG. 5.—*Macraa insulaemaris* P. & H., Sea Isle City, N. J. A.N.S.P. 12558 (× 1½.)
 FIG. 6.—*Terebra curvilineata culvertensis* Martin, Avalon, N. J. A.N.S.P. 14438. (× 2.)
 FIGS. 7, 8.—*Cymatosyrinx casula* P. & H., Shiloh, N. J. A.N.S.P. 12559. (× 2½.)
 FIGS. 9-11.—*Corbula ima* P. & H., Sea Isle City, N. J. A.N.S.P. 12605. (Fig. 9, × 1½; Figs. 10, 11, × 1½.)
 FIG. 12.—*Discinisca lugubris* (Conrad), Shiloh, N. J. N.J.S.M. 10396.
 FIGS. 13, 14.—*Crassinella profundorum* P. & H., Sea Isle City, N. J. A.N.S.P. 12557. (× 5.)
 FIG. 15.—*Ecphora tricostrata* Martin, Sea Isle City, N. J. A.N.S.P. 12521.
 FIG. 16.—*Solarium trilineata* Conrad, Brigantine, N. J. A.N.S.P. 14437. (× 2.)
 FIG. 17.—*Melanella retrocita* P. & H., Shiloh, N. J. A.N.S.P. 12596A. (× 2½.)
 FIGS. 18, 19.—*Fossarus lyra* (Conrad), Shiloh, N. J. N.J.S.M. 10519.
 FIG. 20.—*Oliva sayana* Ravenel, Jericho, N. J. U.S.N.M. 111639.
 FIG. 21.—*Trigonostoma beatum* P. & H., (Type), Shiloh, N. J. A.N.S.P. 12599. (× 1½.)
 FIG. 22.—*Calliostoma tullneri* P. & H., (Type), Sea Isle City, N. J. A.N.S.P. 12556. (× 1½.)

PLATE 18.

- FIGS. 1, 2.—*Chaetopleura apiculata* (Say), Shiloh, N. J. A.N.S.P. 14048. (× 5.)
 FIG. 3.—*Calliostoma eborea* (Conrad), Shiloh, N. J. W.F.I.S. 6891. (× 1½.)
 FIG. 4.—*Turritella plebia* Say, Shiloh, N. J. A.N.S.P. 14055.
 FIGS. 5, 6.—*Turritella cumberlandia* Conrad, Shiloh, N. J. N.J.S.M. 10523.
 FIGS. 7, 8.—*Turritella aequistriata* Conrad, Shiloh, N. J. A.N.S.P. 14042.
 FIG. 9.—*Turritella plebia* Say, Shiloh, N. J. A.N.S.P. 14045.
 FIGS. 10, 11.—*Turritella secta* Conrad, Cumberland County, N. J. N.J.S.M. 10407.

- FIGS. 12, 13.—*Vermetus graniferus* (Say), Sea Isle City, N. J. A.N.S.P. 12530. (× 2.)
- FIG. 14.—*Scalaria marylandica* (Martin), Jericho, N. J. U.S.N.M. 111647. (× 2.)
- FIG. 15.—*Seila clavulus* (Lea), Shiloh, N. J. A.N.S.P. 14049. (× 4.)
- FIG. 16.—*Fossarus dalli* (Whitfield), Shiloh, N. J. A.N.S.P. 14036.
- FIG. 17.—*Crepidula fornicata* (Linné), Cape May Court House, N. J. A.N.S.P. 14051.
- FIG. 18.—*Crepidula plana* Say, Millville, N. J. U.S.N.M. 499141.
- FIGS. 19, 20.—*Crepidula plana* Say, Shiloh, N. J. A.N.S.P. 14028.
- FIGS. 21, 22.—*Crucibulum costatum* (Say), Shiloh, N. J. A.N.S.P. 14039.
- FIG. 23.—*Calyptrea aperta* (Solander), Millville, N. J. U.S.N.M. 499137.
- FIG. 24.—*Calyptrea aperta* (Solander), Shiloh, N. J. N.J.S.M. 10404.

PLATE 19.

- FIGS. 1, 2.—*Xenophora conchliophora* (Born), New Jersey. N.J.S.M. 10403.
- FIG. 3.—*Polinices duplicata* (Say), Shiloh, N. J. U.S.N.M.
- FIG. 4.—*Polinices duplicata* (Say), Shiloh, N. J. A.N.S.P. 14046.
- FIG. 5.—*Polinices tuomeyi* (Whitfield), Shiloh, N. J. A.N.S.P. 14045.
- FIG. 6.—*Polinices heros* (Say), Atlantic City, N. J. A.N.S.P. 14432.
- FIG. 7.—*Polinices triseriata* (Say), Millville, N. J. U.S.N.M. 499132.
- FIGS. 8, 9.—*Polinices hemicrypta* (Gabb), Millville, N. J. U.S.N.M. 499129.
- FIG. 10.—*Muricidea burnsi* (Whitfield), (Type), Jericho, N. J. U.S.N.M. 111626. (× 1½.)
- FIG. 11.—*Muricidea shilohensis* (Heilprin), (Type), Shiloh, N. J. A.N.S.P. 4018.
- FIG. 12.—*Erato perezigua* (Conrad), Jericho, N. J. U.S.N.M. 111638. (× 2½.)
- FIG. 13.—*Sinum fragile* (Conrad), Cape May Court House, N. J. A.N.S.P. 14052.
- FIG. 14.—*Mitrella laevis* (Whitfield), Shiloh, N. J. A.N.S.P. 12594.
- FIG. 15.—*Mitrella laevis* (Whitfield), Millville, N. J. U.S.N.M. 499133.
- FIG. 16.—*Murex millvillensis* new species, (Type), Millville, N. J. U.S.N.M. 498975.
- FIG. 17.—*Fasciolaria woodi* Gabb, (Type), Shiloh, N. J. A.N.S.P. 14038.
- FIG. 18.—*Coralliophila cumberlandia* (Gabb), (Type), Shiloh, N. J. A.N.S.P. 4314.
- FIG. 19.—*Rapana ecclesiastica* Dall, Sea Isle City, N. J. A.N.S.P. 12523.
- FIG. 20.—*Mitrella communis mediocris* P. & H., (Type), Shiloh, N. J. A.N.S.P. 12590. (× 1½.)

PLATE 20.

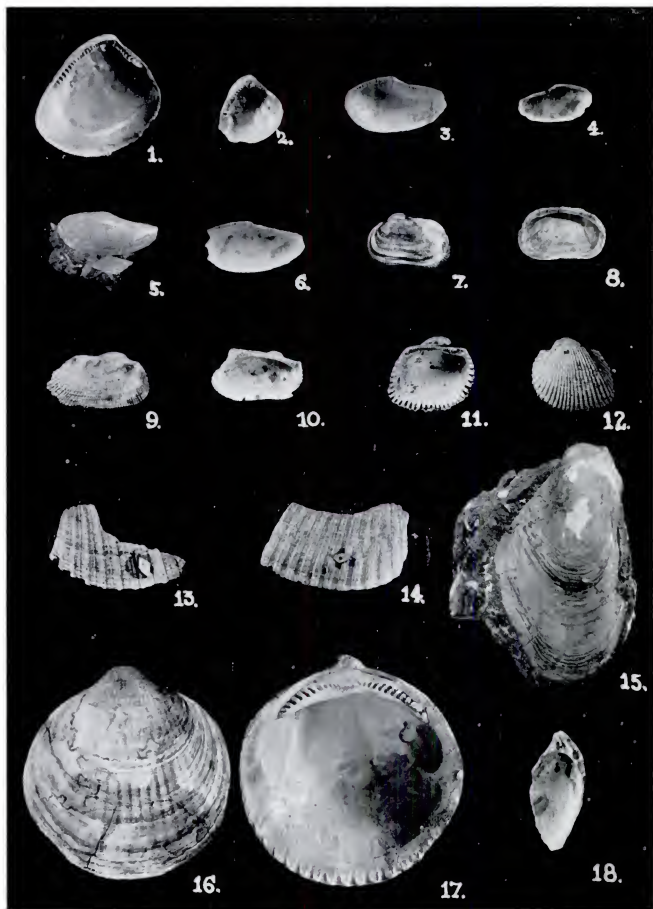
- FIG. 1.—*Siphonalia deveza* (Conrad), Millville, N. J. U.S.N.M. 499125.
- FIGS. 2, 3.—*Busycon tuberculatum* (Conrad), Millville, N. J. U.S.N.M. 499121.
- FIGS. 4, 5.—*Busycon scalarispira* Conrad, Shiloh, N. J. A.N.S.P. 14439.
- FIG. 6.—*Busycon scalarispira* Conrad, Cape May Court House, N. J. C.M.C.H.
- FIG. 7.—*Nassarius trivittatoides* (Whitfield), Shiloh, N. J. A.N.S.P. 14034. (× 5.)
- FIGS. 8, 9.—*Nassarius sopora* (P. & H.), (Type and paratype), Sea Isle City, N. J. A.N.S.P. 12604. (× 1½.)
- FIG. 10.—*Nassarius trivittatoides elongata* (Whitfield), Shiloh, N. J. U.S.N.M. 111633. (× 5.)
- FIG. 11.—*Nassarius trivittatoides* (Whitfield), Shiloh, N. J. A.N.S.P. 14034. (× 5.)
- FIG. 12.—*Nassarius bidentata* (Emmons), Shiloh, N. J. U.S.N.M. 111634. (× 5.)
- FIG. 13.—*Turbonilla interrupta* Totten, Shiloh, N. J. A.N.S.P. (× 5.)

PLATE 21.

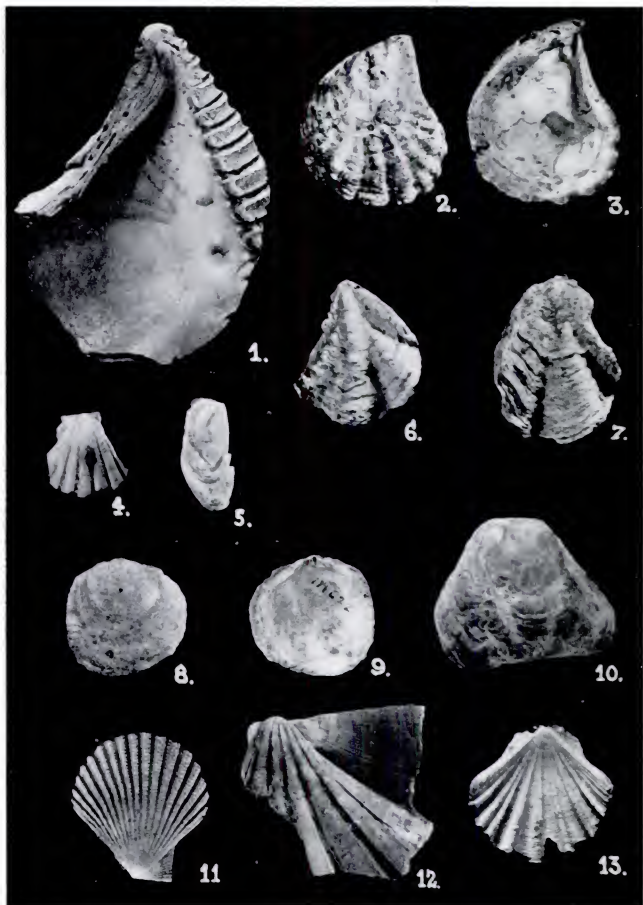
- FIG. 1.—*Cancellaria alternata* Conrad, Shiloh, N. J. A.N.S.P. 12591.
 FIGS. 2, 3.—*Cancellaria reticulatoides* Martin, Millville, N. J. U.S.N.M. 559165.
 FIGS. 4, 5.—*Trigonostoma planasuturata* new species, (Type), Millville, N. J. U.S.N.M. 498977.
 FIG. 6.—*Oliva sayana* Ravenel, Avalon, N. J. A.N.S.P. 14441.
 FIG. 7.—*Bulliopsis integra* (Conrad), Cape May, N. J. N.J.S.M. 10409.
 FIG. 8.—*Bulliopsis integra* (Conrad), Cape May, N. J. U.S.N.M. 115737.
 FIG. 9.—*Fissuridea griscomi* (Conrad), Shiloh, N. J. A.N.S.P. 14435.
 FIG. 10.—*Pleuroliria ultima foxi* P. & H., (Type), Shiloh, N. J. W.F.I.S. 6884. (× 2.)
 FIG. 11.—*Pleuroliria ultima* P. & H., (Type), Shiloh, N. J. A.N.S.P. 12569. (× 2.)
 FIG. 12.—*Cymatosyrinx pseudeturnea* (Heilprin), (Type), Shiloh, N. J. A.N.S.P. 502. (× 1½.)
 FIG. 13.—*Cymatosyrinx pseudeturnea* (Heilprin), Shiloh, N. J. A.N.S.P. 12592. (× 1½.)
 FIG. 14.—*Cymatosyrinx whitfieldi* P. & H., Shiloh, N. J. W.F.I.S. 6885. (× 1½.)
 FIG. 15.—*Cymatosyrinx polycyma* P. & H., Shiloh, N. J. A.N.S.P. 12593. (× 1½.)
 FIGS. 16, 17.—*Kurtziella precerina* P. & H., (Type and paratype), Shiloh, N. J. A.N.S.P. 12589. (× 2.)
 FIG. 18.—*Cerithidea insulaemaris* P. & H., (Type), Sea Isle City, N. J. A.N.S.P. 12558. (× 1½.)
 FIG. 19.—*Glyphostoma subflexuosum* P. & H., Shiloh, N. J. A.N.S.P. 12593. (× 1½.)
 FIG. 20.—*Triphora terebrata* Heilprin, Shiloh, N. J. A.N.S.P. 14032. (× 5.)
 FIG. 21.—*Acteocina wetherilli* (Lea), (Type), Deal, N. J. A.N.S.P. 14431. (× 2.)
 FIG. 22.—*Volvula iota* (Conrad), Shiloh, N. J. A.N.S.P. 14050. (× 2.)
 FIG. 23.—*Acteon ovoides* Conrad, Sea Isle City, N. J. A.N.S.P. 12531.
 FIGS. 24, 25.—*Acteon shilohensis* Whitfield, (Type), Shiloh, N. J. U.S.N.M. 111627. (× 2.)
 FIG. 26.—*Terebra whitfieldi* Martin, Millville, N. J. U.S.N.M. 499142.
 FIGS. 27, 28.—*Terebra whitfieldi* Martin, Sea Isle City, N. J. A.N.S.P. 12511.
 FIGS. 29, 30.—*Terebra curvilirata* Conrad, Bridgeton, N. J. A.N.S.P. 14033.
 FIGS. 31, 32.—*Terebra inornata* Whitfield. N.J.S.M. 10408.
 FIG. 33.—*Cancellaria shilohensis* P. & H., Shiloh, N. J. A.N.S.P. 12600.

PLATE 22.

- FIG. 1.—*Acanthodesia savarti* (Audouin), Millville, N. J. U.S.N.M. 499142. (× 5.)
 FIG. 2.—*Astrangia danae* Agassiz, Sea Isle City, N. J. A.N.S.P. 12553.
 FIG. 3.—*Astrangia danae* Agassiz, Sea Isle City, N. J. A.N.S.P. 14025.
 FIGS. 4, 5.—*Echinarachnius* sp., Cape May Court House, N. J. A.N.S.P. 14056.
 FIGS. 6, 7.—*Balanus shilohensis* Pilsbry, Shiloh, N. J. A.N.S.P. 4728. (× 2½.)
 FIGS. 8-10.—*Balanus shilohensis* Pilsbry, Shiloh, N. J. A.N.S.P. 4728. (× 1½.)
 FIGS. 11-16.—*Balanus withersi* Pilsbry, Shiloh, N. J. A.N.S.P. 4727. (× ½.)
 FIG. 17.—*Balanus concavus proteus* Conrad, Shiloh, N. J. A.N.S.P. 14022.
 FIGS. 18, 19.—*Cadulus conradi* P. & H., (Type), Shiloh, N. J. A.N.S.P. 12596B. (× about 2.)
 FIG. 20.—*Dentalium caduloide* Dall, Wildwood, N. J. A.N.S.P. 14440. (× 4.)



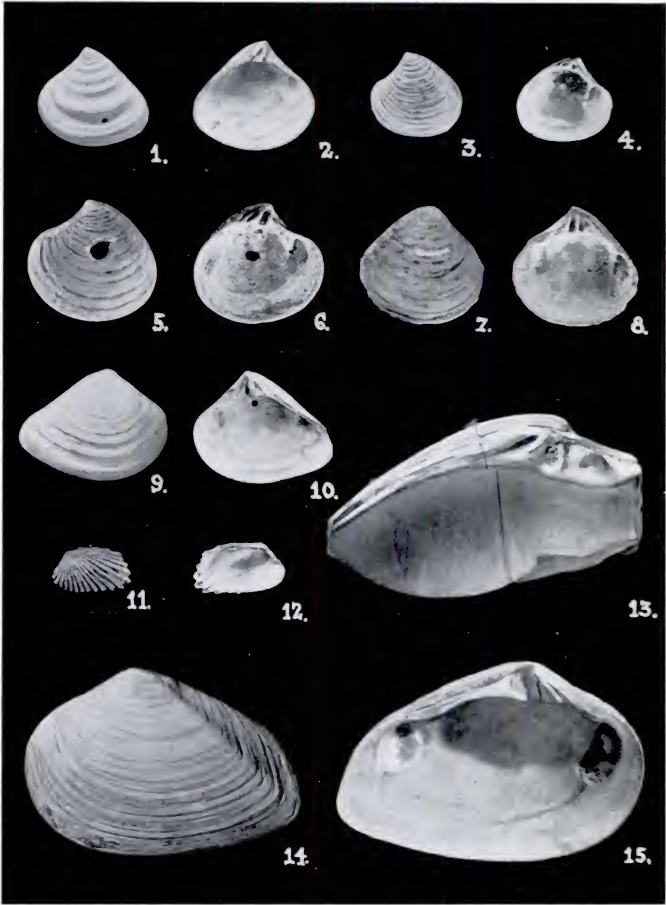
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



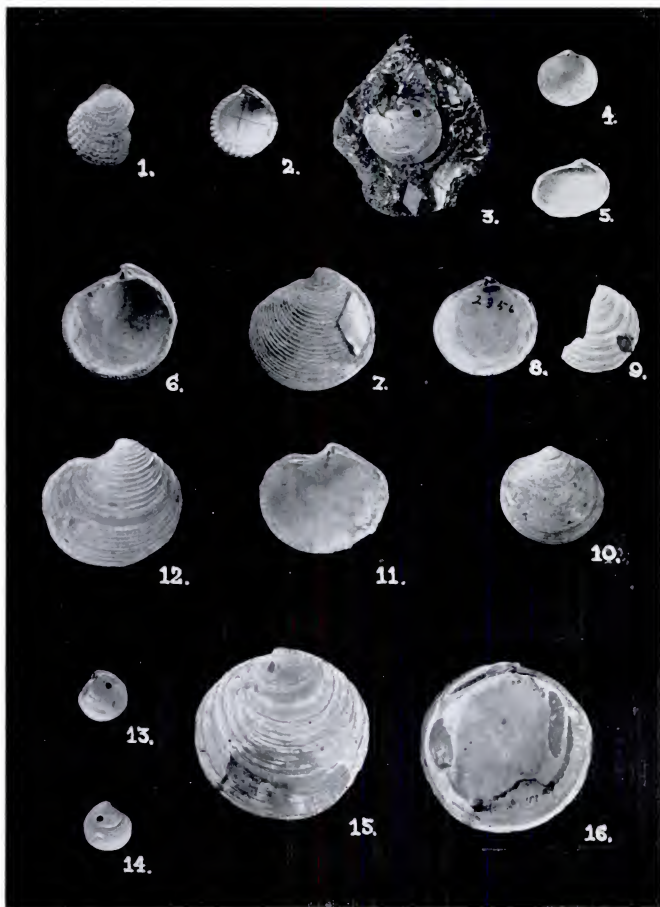
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



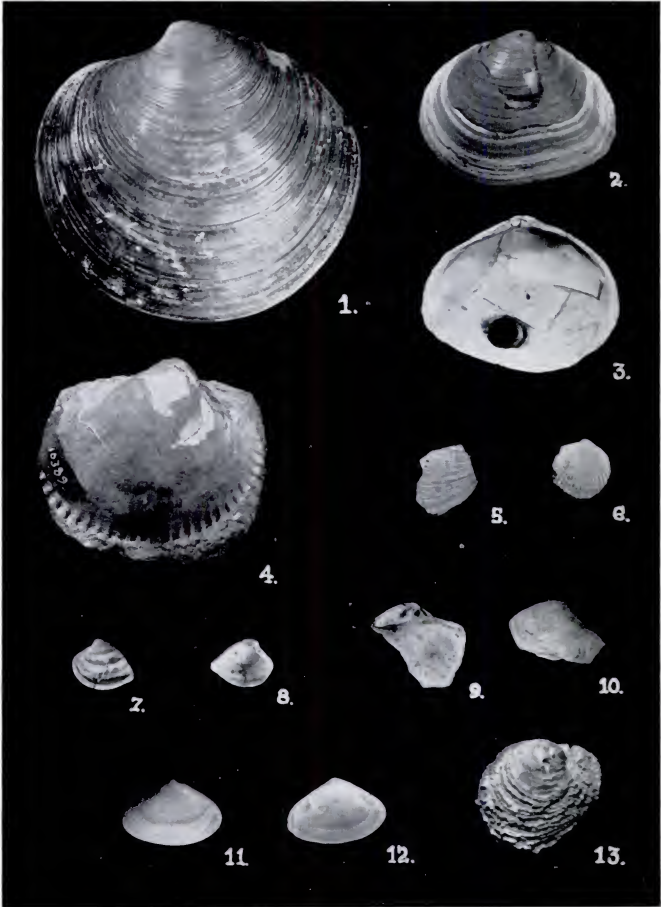
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



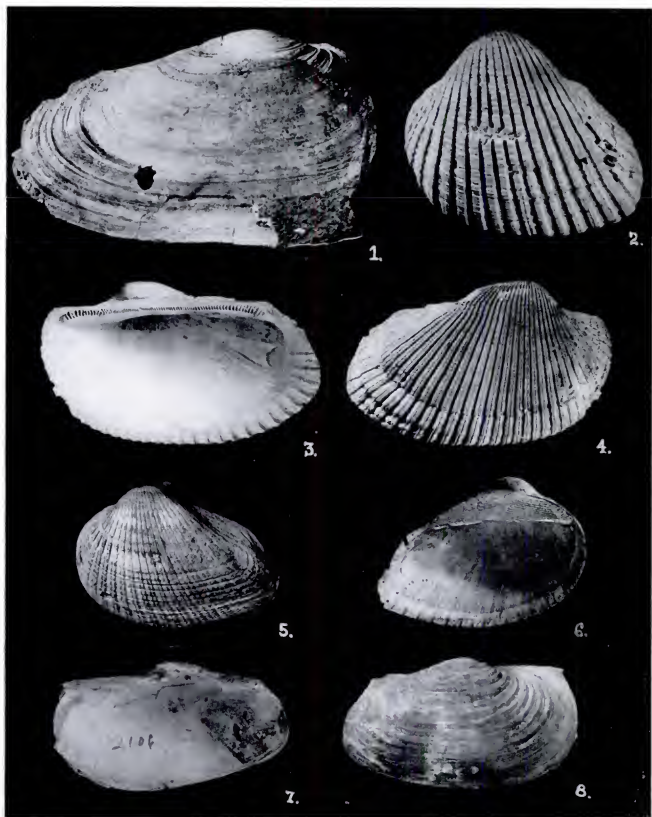
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



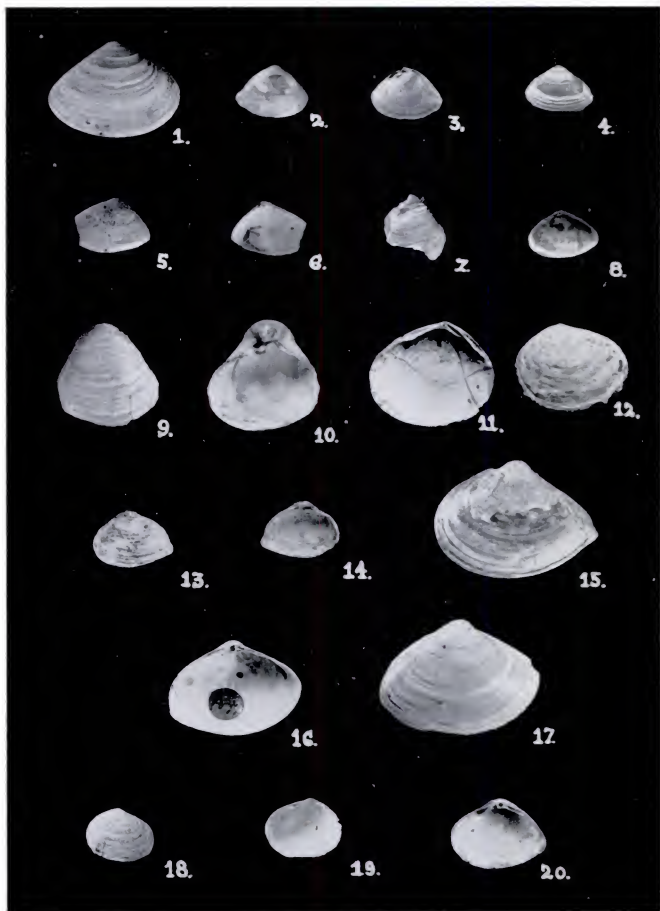
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



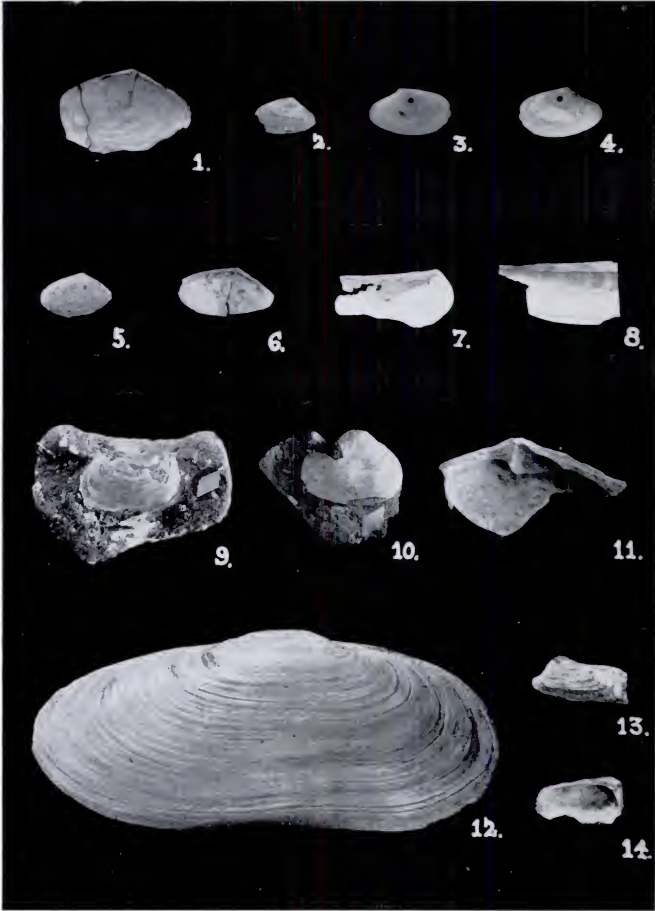
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



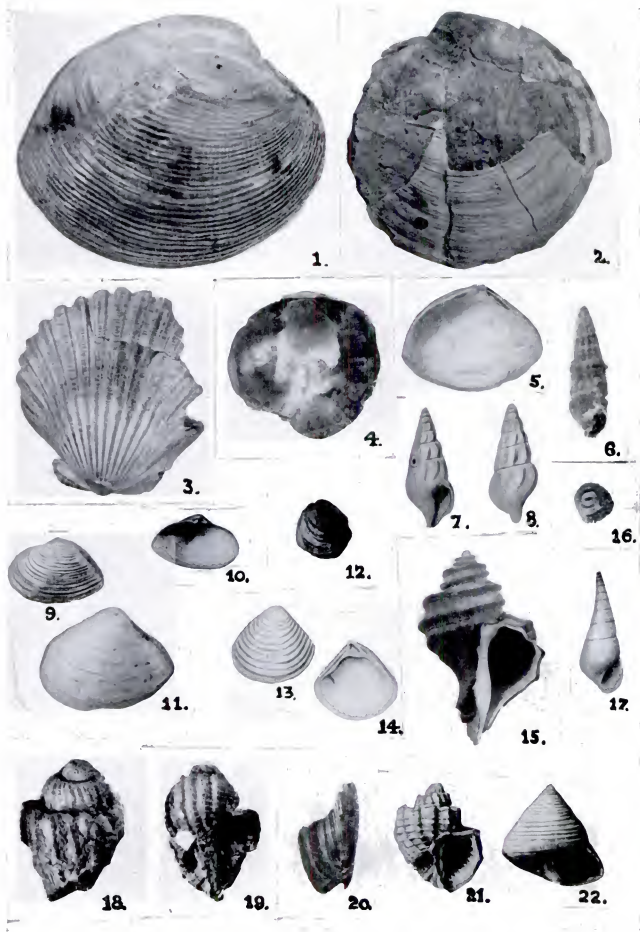
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



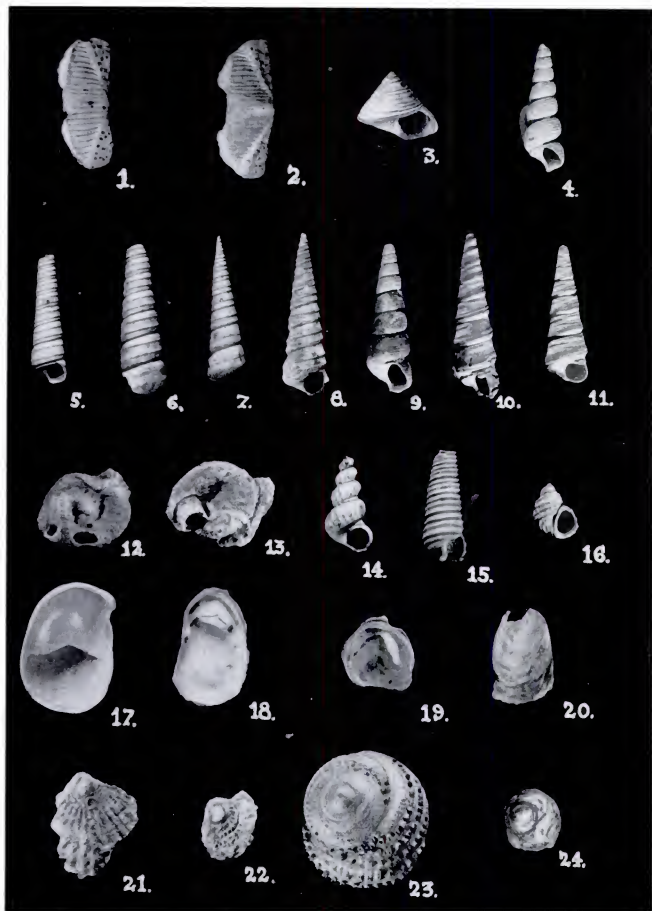
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



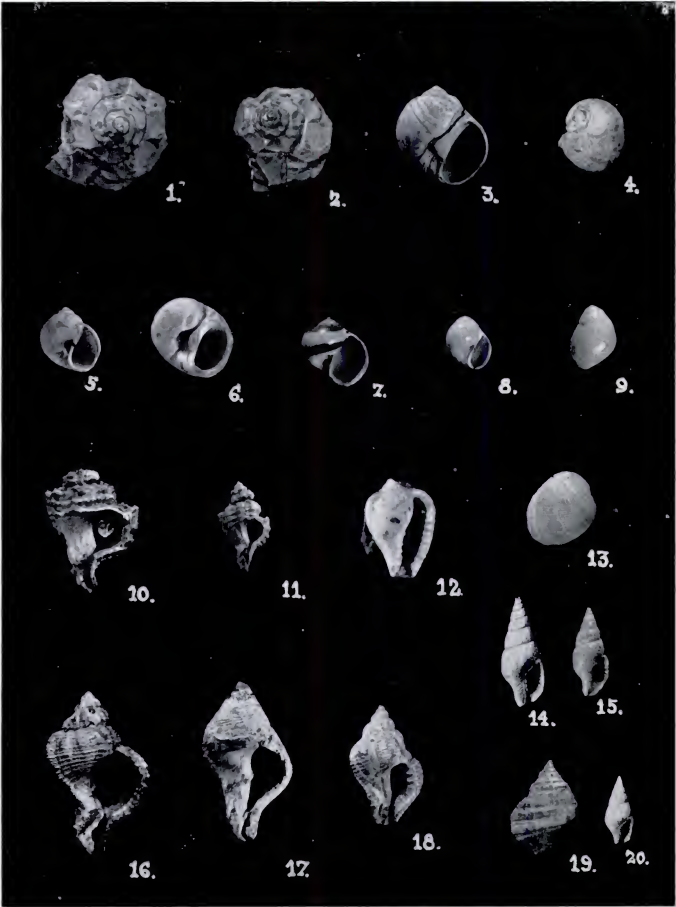
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY

1. 2. 3.

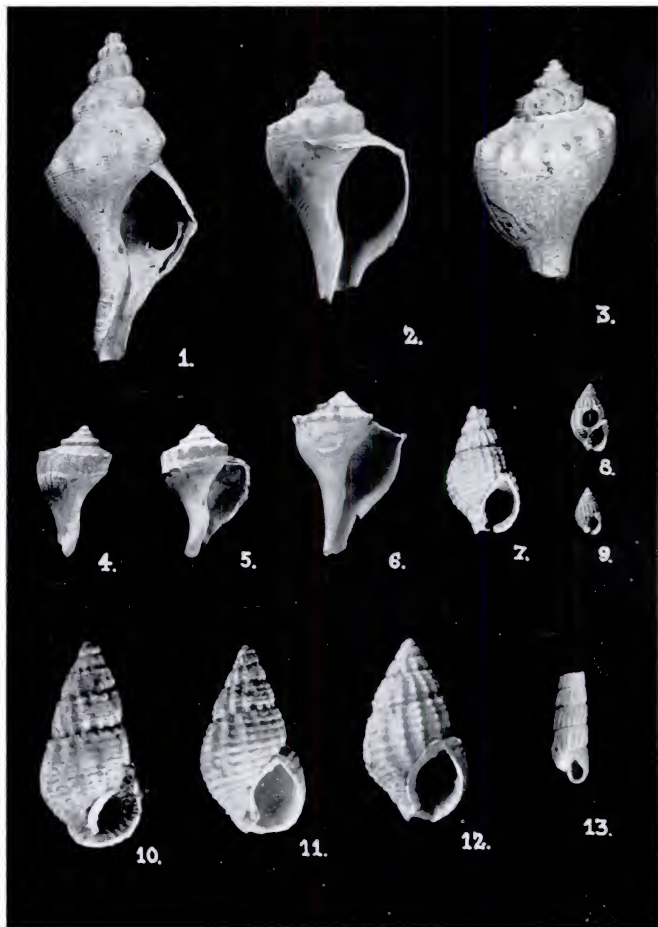
4.



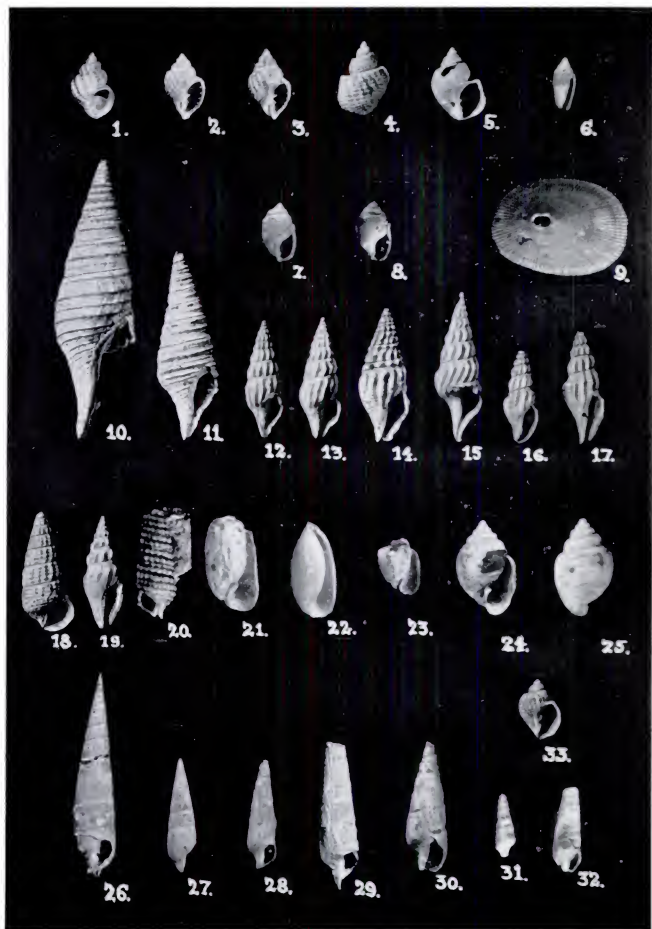
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



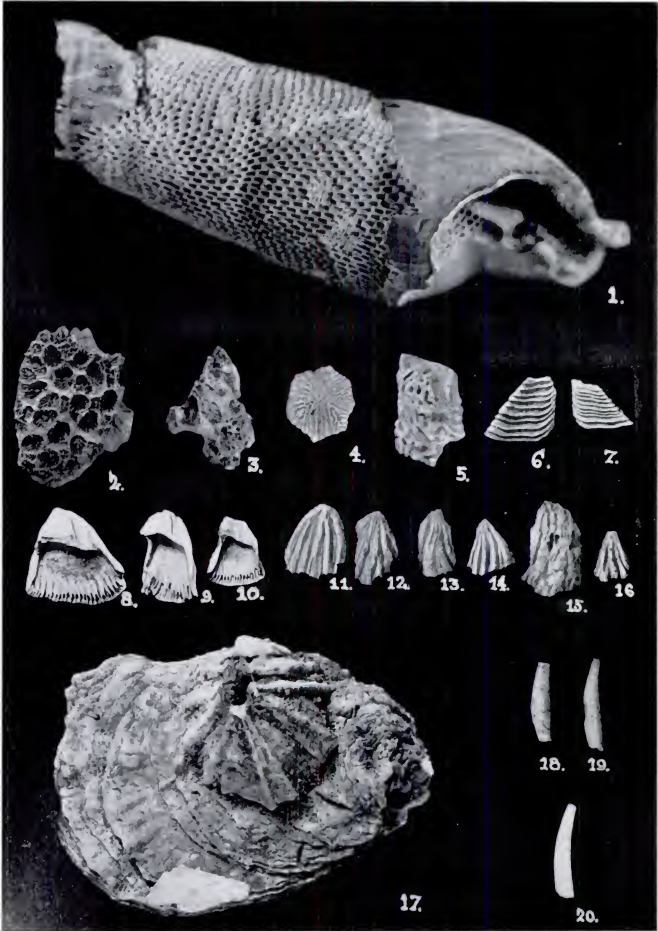
RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY



RICHARDS AND HARBISON: MIOCENE INVERTEBRATE FAUNA
OF NEW JERSEY

THE ROTATORIAN FAUNA OF THE POCONO PLATEAU AND ENVIRONS

BY FRANK J. MYERS

*Research Fellow in Microscopy, Department of Microscopy, The Academy
of Natural Sciences of Philadelphia*

This report is based on a large number of collections made during the summers of 1939, 1940, and 1941, among the various bodies of water in that region of northeastern Pennsylvania known as the Pocono Plateau. This region, as understood here, embraces a large portion of Monroe, Pike, and some of Carbon Counties. Only in certain instances were collections made outside those limits.

The Plateau was selected because of the great diversity in environment afforded by the various bodies of water; their differences in altitude, their extensive range in hydrogen-ion concentration and other hydrographic characters; in order that the effect of certain chemical and biological factors on the distribution of the *Rotatoria* could be observed.

The locations visited not strictly within the limits of the Plateau were selected because of their lower altitude and more alkaline waters, thus providing data used in comparing these bodies of water with those of the Plateau proper, the waters of which are all acid.

Since there is every conceivable intergrade from one body of water to another, the distinction between a lake and a pond is purely arbitrary. For our purpose, a lake is considered to be a permanent body of water deep enough to stratify thermally and in which the littoral zone of floating vegetation does not extend to the middle of the basin. A pond is considered to be a shallow body of water which does not stratify thermally and in which the zone of floating vegetation extends to the middle of the basin.

The majority of the Pocono bodies of water fall into the second category although many are commonly called lakes. Most of them are wide-spreads, along larger or smaller streams, produced by damming, the original purpose of which was log storage.

Not only were collections made at regular intervals, but samples of water were taken from the first nine lakes (see following list of locations) at regular intervals and sent to the Osborn Zoological Laboratory, Yale University, where, through the kindness of Dr. G. E. Hutchinson and Mr. W. T. Edmondson, the samples were analyzed for bicarbonates, calcium, conductivity (total salts), and color.¹

¹ An ecological discussion embracing rotifer distribution correlated to hydrogen-ion concentration, chemistry of the water, vegetation, and various species of rotifers showing a limitation to the above factors will be included in a separate report.

The data thus obtained, together with the faunal lists, aided greatly in clarifying certain problems of rotifer distribution heretofore not fully understood.

All littoral collections were made by the *plant method*, in which submerged aquatics were detached and transferred to wide-mouth containers, then filled with water from the same source. The plants were never crowded; only enough placed in the containers so, on holding towards the light, one could see through indistinctly. This trapped the rotifers among the interstices of the leaves and stems while washing off many of the larger, undesirable organisms.

On arriving at the laboratory the containers were placed several feet from the source of light, generally a window, and allowed to stand for a certain length of time, depending on temperature and the elapsed interval between collecting and arrival home. The heavier vitiated water gradually sank to the bottom and the lighter, purer water ascended to the top.

After a certain interval, the rotifers came out from among the plants and ascended with the fresher water. They eventually reached the surface and assembled on the side nearer the light, finally crowding up into the meniscus, from where they were transferred to watch glasses for observation, killing, and fixing.

Limnetic species were collected with a plankton net in the usual manner.

All rotifers were examined in the living state as far as possible. Many samples of preserved material were prepared.

Many species react differently to the several methods of narcotizing adopted. Therefore, a knowledge of these reactions is essential for killing illoricated forms in an expanded, life-like condition.

The following methods of killing and preserving were used:

1. About 3 cc. of water containing rotifers was drawn from the meniscus and transferred to a large, deep watch glass. If the source of the collection was acid water, 3 or 4 drops of a 1 percent solution of neo-synephrin hydrochloride was added and repeated at five-minute intervals. When the rotifers settled to the bottom and ciliary action had virtually ceased, 3 drops of a one-half percent solution of osmic acid was added, water agitated and after about five minutes decanted, and repeated three times at fifteen-minute intervals. The rotifers were preserved in a 2 percent solution of formalin.

For rotifers collected in alkaline water, exactly the same method was used, substituting a solution made up of novocain, 1 gr.; methyl alcohol, 10 cc.; distilled water, 10 cc., instead of the neo-synephrin.

2. About 3 cc. of water containing rotifers was drawn from the meniscus and transferred to a watch glass. After a short interval, in order to allow the animals to recover from shock, a like amount or somewhat more of boiling water was suddenly poured into the center of the watch glass.

When the water had cooled, three or four drops of a 40 percent solution of formalin was added. Many illoricated species may be killed extended in this manner better than in any other.

3. A portion of each collection was placed directly in about 2 percent formalin in order to preserve the loricated species in a fully contracted condition necessary for determination.

The author deeply appreciates the kind help given, both in the laboratory and field, by Mr. W. T. Edmondson, New Haven, Connecticut; Mr. Leonard M. Bennetch, Bethlehem, Pennsylvania; Mr. Albert Turner, Haverford, Pennsylvania, and Mr. Louis M. Dorsey, Jr., Germantown, Pennsylvania.

List of Locations

1. **Green Pond**, Northampton County. Altitude 400 feet. Length about 1 Km.

A small body of water almost round in shape, formed by old wells and springs in center. Surrounded by open farming country. Water very turbid. Principal aquatics, *Najas flexilis*; sparse patches of *Elodea canadaensis* and *Potamogeton foliosus*. Average pH, 8.1.

2. **Popomoning (Sailor's) Lake**, Monroe County. Altitude 660 feet. about .7 Km.

A deep body of water ovoid in shape, formed by glacial action. Surrounded by hilly wooded moraines. Water clear. Principal aquatics, *Najas flexilis*, *Elodea canadaensis* and *Potamogeton foliosus*. Average pH, 8.1.

3. **Wier Lake**, Monroe County. Altitude 700 feet. Length about .2 Km.

A pond, roundish in shape, formed by damming Wier Creek. Surrounded by fairly level farming country. Water turbid. Principal aquatics, *Fontinalis antipyretica*, *F. disticha*, *Elodea canadaensis*; some *Utricularia vulgaris*, *Potamogeton epihydrus*, *Ceratophyllum echinatum*, and *Lemna minor*. Average pH, 6.8.

4. **Mountain Lake**, Monroe County. Altitude about 600 feet. Length about .5 Km.

A narrow pond formed by damming Pond Creek. Surrounded by open farming country. Water turbid. Principal aquatics, *Najas flexilis*, *Elodea canadaensis*, *Potamogeton epihydrus*, *Ceratophyllum demersum*, *Chara vulgaris*, and *Lemna minor*. Average pH, 7.0.

5. **Trout Lake**, Monroe County. Altitude 960 feet. Length about 1 Km.

An oblong pond formed by damming Mountain Spring Creek. Surrounded by open farming country. Water fairly clear. Principal aquatics, *Najas flexilis*, *Elodea canadaensis*, and *Potamogeton epihydrus*. Average pH, 6.8.

6. **Harvey Lake**, Luzerne County. Altitude 1230 feet. Length about 4 Km.

The largest natural lake in Pennsylvania. A deep body of water of irregular outline, formed by glacial action. Surrounded by wooded moraines and farming country. Water clear. Principal aquatics, *Najas flexilis*, *Elo-dea canadaensis*, *Potamogeton perfoliatus*, *P. epihydrus*, *P. crispus*, *Ranunculus trichophyllus*, *Megalodonta beekii*, *Fontinalis disticha*, and *Ceratophyllum demersum*. Average pH, 7.0.

7. **Pocono Lake**, Monroe County. Altitude 1640 feet. Length about 5 Km.

A long pond of irregular outline, formed by damming the Tobyhanna Creek. Surrounded by hilly wooded country. Water brownish, somewhat turbid. Principal aquatics, *Najas flexilis*, *Myriophyllum humile*, large patches; *Nitella flexilis*, large patches; *Potamogeton epihydrus*, *Fontinalis Novae-Angliae*, adhering to submerged stumps and rocks; *F. disticha*, *Sphagnum subsecundum*, *Drepanocladus exannulatus*, large patches, and *Eleocharis acicularis* lining certain areas of the shore. This sedge becomes detached and wind-blown, forming floating patches along the shore which become excellent associations in which to collect rotifers. Average pH, 6.4.

8. **Lake Tamaque**, Monroe County. Altitude 1800 feet. Length about .4 Km.

A round pond formed by damming Beaver Creek. Surrounded by hills and low forest. Water brownish, turbid. Principal aquatics, *Myriophyllum humile*, large patches; *Sphagnum cuspidatum*, *Utricularia vulgaris*, and small areas of *Cladopodiella fluitans* floating among the *Sphagnum*, *Fontinalis Novae-Angliae*, *F. disticha*. Average pH, 4.2.

9. **Indian Lake**, Lackawanna County. Altitude 1960 feet. Length about .7 Km.

An oblong body of water formed by glacial action. Surrounded by hilly forests. Water clear. Principal aquatics, *Najas flexilis*, *Potamogeton foliosus*, *P. epihydrus*, *Eleocharis acicularis*, and *Fontinalis disticha*. Average pH, 5.0.

10. **Pocono Pond**, Monroe County. Altitude 1660 feet. Length about .1 Km.

A small, round, shallow body of water adjacent to Pocono Lake. Surrounded by low trees and brush. Water fairly clear. Principal aquatics, *Drepanocladus exannulatus* and *Utricularia vulgaris*. Average pH, 6.1.

This location is of exceptional interest because of the mixed rotatorian fauna it contains, which is about half way between typical acid and alkaline. It will be referred to again.

11. **Round Pond**, Carbon County. Altitude 1785 feet. Length about .2 Km.

A round senescent body of water formed by glacial action. Surrounded by low moraines and forest. Water clear. Principal aquatics, *Utricularia purpurea*, *Sphagnum cuspidatum*, and *Algae* sp.? in great submerged patches. Average pH, 4.5.

12. **Twin Lakes**, Monroe County. Altitude 1950 feet. Length about 1.5 Km.

A pond formed by damming Pocono Creek. Shaped like an hour-glass and surrounded by hilly, wooded country. Water brown, turbid. Principal aquatics, *Utricularia gibba*, *Sphagnum cuspidatum*, *Drepanocladus exannulatus*, and *Fontinalis disticha*. Average pH, 4.0.

13. **Pecks Pond**, Pike County. Altitude 1360 feet. Length about 4 Km.

A shallow wide-spread of irregular shape, reclaimed from marsh land by damming a stream. Surrounded by rather hilly densely wooded country. Water clear. Principal aquatics, *Drepanocladus exannulatus*, *Fontinalis Novae-Angliae*, *Utricularia vulgaris*, *Potamogeton epihydrus*, *Elodea occidentalis*, *Ceratophyllum demersum*, and some *Lemna minor* in small protected bays. Average pH, 6.2.

14. **Lake Mineola**, Monroe County. Altitude 740 feet. Length about .3 Km.

A roundish body of water formed by glacial action. Surrounded by wooded moraines and farming country. Water somewhat turbid. Principal aquatics, *Najas flexilis*, *Utricularia vulgaris*, *Potamogeton epihydrus*, *P. foliosa*, and *Elodea canadensis*. Average pH, 7.0.

15. **Shawnee Lake**, Monroe County. Altitude about 550 feet. Length about .5 Km.

An oblong pond formed by damming Shawnee Creek. Surrounded by open farming country. Water somewhat turbid. Principal aquatics, *Najas flexilis*, *Potamogeton crispus*, *P. zosteriformis*, *Elodea canadensis*, *Ceratophyllum demersum*, and *Chara vulgaris*. Average pH, 7.8.

16. **Deep Run Dam**, Pocono Lake Preserve, Monroe County.

A long narrow wide-spread formed by damming Deep Run. Surrounded by hilly wooded country. Water turbid. Principal aquatics, *Eleocharis acicularis*, detached mats in coves along the shore. Average pH, 5.2.

17. **Long Pond**, Monroe County. Altitude 1850 feet. Length about 6 Km.

A long, narrow meandering wide-spread of the Tunkhannock Creek. Surrounded by scrub oak and farming country. Water brownish, somewhat turbid. Principal aquatics, *Utricularia vulgaris*, large patches; *Potamogeton epihydrus*, *Sphagnum cuspidatum*, *Myriophyllum humile*, and *Fontinalis Novae-Angliae*. Average pH, 6.5.

18. **Promised Land Lake**, Pike County. Altitude 1725 feet. Length about 5 Km.

A pond of irregular shape, reclaimed from marsh land by damming a stream, thus flooding the area. Surrounded by fairly hilly, heavily wooded

country. Water rather clear. Principal aquatics, *Najas flexilis*, *Utricularia vulgaris*, *Elodea occidentalis*, *Potamogeton epihydrus*, *Drepanocladus exanulatus*, and *Fontinalis Novae-Angliae*. Average pH, 6.5.

19. **Naomi Lake**, Monroe County. Altitude 1800 feet. Length about 3 Km.

A pond formed by damming the Tobyhanna Creek. Surrounded by rather hilly, wooded country. Water brownish, somewhat turbid. Principal aquatics, *Najas flexilis*, *Myriophyllum humile*, large patches; *Fontinalis Novae-Angliae* adhering to submerged stumps and rocks; some *Utricularia vulgaris* and *Nitella flexilis*. Average pH, 6.2.

20. **Tobyhanna Creek**, Monroe County.

A mountain stream of which Pocono Lake is a wide-spread. It empties into the Lehigh River at Stoddartsville, Luzerne County. Principal aquatics, *Fontinalis Novae-Angliae* clinging to rocks and some *Sparganium angustifolium*. pH, 6.4.

21. **Davy Run**, Monroe County.

A mountain torrent arising on the Pocono Lake Preserve and emptying into the Tobyhanna Creek. Principal aquatics, *Fontinalis dalecarlica* and some *Sparganium angustifolium*. pH, 5.8.

22. **Kendall Creek**, Lackawanna County. Altitude about 1900 feet.

A small mountain stream draining a marsh, and emptying into the Lehigh River near Thornhurst, Lackawanna County. Principal aquatics, *Sphagnum cuspidatum* and *Fontinalis dalecarlica* clinging to submerged rocks.

23. **Wagners Run**, Monroe County. Altitude 1800 feet at source.

A small mountain stream emptying into Pocono Lake. Principal aquatics, *Fontinalis antipyretica*, at outlet of springs; *Nitella flexilis* and *Sphagnum cuspidatum*. pH, 6.2.

24. **Mill Creek**, near Angels, Wayne County. Altitude about 1800 feet.

A mountain stream emptying into the Paupack Creek. Principal aquatics, various bryophytes clinging to partially submerged rocks.

ANNOTATED FAUNAL LIST

ORDER MONOGONONTA

Numbers following specific names indicate locations where found.

No numbers following specific names indicate the species to be commonly distributed throughout the plateau.

Capital letters following specific names or location numbers indicate mounted specimens of that species are to be found in the collections of the, USNM—United States National Museum, Washington, D. C.; AMNH—American Museum of Natural History, New York City; ANSP—Academy of Natural Sciences of Philadelphia, Philadelphia, Pa.

- Albertia intrusor* Gosse. 7, 12, 13, 16. AMNH, ANSP
Albertia tryphlina Harring and Myers. 23
Anuraeopsis fissa (Gosse). 1. AMNH, ANSP
Ascomorpha agilis Zacharias. 4, 5, 7, 10, 11, 13, 14, 17, 19. AMNH, ANSP
Ascomorpha agilis var. *americana* de Beauchamp. 5, 11, 17, 19. AMNH
Ascomorpha ecaudis Perty. USNM, AMNH, ANSP
Ascomorpha minima Hofsten. 7, 12, 17, 19. AMNH, ANSP
Ascomorpha saltans Bartsch. 6, 7, 12, 17. USNM, ANSP
Aspelta aper (Harring). 6, 7, 8, 11, 12, 16, 23. USNM, AMNH, ANSP
Aspelta beltista Harring and Myers. 7, 11, 21, 24. USNM, AMNH, ANSP
***Aspelta chorista* new species.** 10. ANSP
Aspelta circinator (Gosse). 7, 8, 12, 13, 17, 21. AMNH, ANSP
Aspelta labri Harring and Myers. 13. AMNH
Aspelta lestes Harring and Myers. 10. ANSP
Asplanchna herrickii de Guerne. 7, 10, 13, 19. USNM, AMNH, ANSP
Asplanchna priodonta Gosse. 5, 7. USNM, AMNH, ANSP
Asplanchna seiboldii (Leydig). 1. AMNH, ANSP
Asplanchnopus multiceps (Schränk). 4, 5, 6, 14, 15. USNM, AMNH, ANSP
Asplanchnopus dahlgreni Myers. 7, 13, 17, 18, 19. USNM, AMNH, ANSP
Beauchampia crucigera (Dutrochet). 19
Brachionus angularis Gosse. 1, 14, 15. USNM, AMNH, ANSP
Brachionus calyciflorus f. *amphiceros* (Ehrenberg). 1. USNM, AMNH, ANSP
Brachionus quadridentatus Hermann. 1, 3, 4, 7, 10, 13, 15. USNM, AMNH, ANSP
Brachionus urceolaris Müller. 1. USNM, AMNH, ANSP
Brycella tenella (Bryce). 7. ANSP. *Sphagnum*.
Cephalodella abstrusa Myers. 7. ANSP. *Sphagnum*.
Cephalodella akrobeles Myers. 5, 8, 10, 16. AMNH, ANSP
Cephalodella apocolea Myers. USNM, AMNH, ANSP
Cephalodella apsicora Myers. 8. AMNH, ANSP
***Cephalodella asarcia* new species.** 12. ANSP
Cephalodella auriculata (Müller). AMNH, ANSP
Cephalodella belone Myers. 11, 19. AMNH, ANSP
Cephalodella catellina f. *ahlstromi* Hutchinson and Edmondson. 14. AMNH, ANSP
Cephalodella compacta Wiszniewski. 7. USNM, AMNH, ANSP. Psammobiotic.
Cephalodella compressa Myers. 7, 11, 12, 16. AMNH, ANSP. *Sphagnum*.
Cephalodella conjuncta Myers. 7. ANSP

Cephalodella crassipes (Lord). 24. USNM, ANSP. Fluvial.

Diaschiza crassipes Lord, Trans. Manchester Micr. Soc., 1903, p. 78, pl. 3, fig. 3.

Cephalodella xenica Harring and Myers, Trans. Wisconsin Acad. Sci. Arts, Letters, 1924, p. 492, pl. 29, fig. 6.

Cephalodella eupoda Harring and Myers, Trans. Wisconsin Acad. Sci. Arts, Letters, 1924, p. 512, pl. 36, fig. 7.

Lord described his animal from a single specimen collected amongst Algae growing on the face of a small cascade about one-half mile from his home.

It was collected in large numbers under the same conditions near Johnstown, New York, in 1929.

Cephalodella xenica was originally found in the Huron River, Michigan, and *C. eupoda* in a small stream (Four Mile Run), near Washington, District of Columbia.

Cephalodella dorseyi Myers. 7. AMNH, ANSP

Cephalodella elongata Myers. 12. USNM, AMNH

Cephalodella eunoma Myers. 4, 7. ANSP

Cephalodella eva (Gosse). 4, 6, 7, 13, 16, 19, 22, 23. AMNH, ANSP

Cephalodella exigua (Gosse). USNM, AMNH, ANSP

Cephalodella forficata (Ehrenberg). 7, 13, 17. USNM, AMNH, ANSP

Cephalodella forficula (Ehrenberg). AMNH, ANSP

Cephalodella galbina Myers. 17. USNM, AMNH, ANSP

Cephalodella gibba (Ehrenberg). USNM, AMNH, ANSP

Cephalodella globata (Gosse). AMNH, ANSP

Cephalodella gracilis (Ehrenberg). USNM, ANSP

Cephalodella hiulca Myers. 7, 16, 17. AMNH, ANSP

Cephalodella hoodii (Gosse). 4, 6, 7, 23. AMNH, ANSP

Cephalodella hyalina Myers. 7, 8. AMNH, ANSP

Cephalodella intuta Myers. USNM, AMNH, ANSP

Cephalodella licinia Myers. Half-moon Pond, Monroe County. ANSP.

Sphagnum

Cephalodella lipera Myers. 23. ANSP. *Sphagnum*.

Cephalodella megalcephala (Glasscott). 1, 3, 4, 5, 6, 7, 13, 19. USNM, AMNH, ANSP

Cephalodella mira Myers. 7, 8, 10, 19, 22. ANSP. *Sphagnum*.

Cephalodella montana new species. 4. ANSP

Cephalodella mucosa Myers. 7, 8. AMNH, ANSP

Cephalodella mucronata Myers. 7, 8, 12, 17. USNM, AMNH, ANSP.

Sphagnum

Cephalodella nana Myers. 8

Cephalodella nelitis Myers. 7, 8, 16, 17. USNM, ANSP. *Sphagnum*.

Cephalodella panarista Myers. 7. USNM, AMNH, ANSP

Cephalodella parasitica (Jennings). 14, 16. USNM, AMNH, ANSP

- Cephalodella physalis* Myers. 22. AMNH, ANSP
Cephalodella planera Myers. 17. ANSP
Cephalodella plicata Myers. 8. AMNH. *Sphagnum*.
Cephalodella remanei Wiszniewski. 7, 8, 22. AMNH, ANSP
ANSP

Cephalodella sabulosa new species. 7. ANSP. Psammobiotic.

Cephalodella strepta Myers. 22. AMNH

Cephalodella subsecunda new species. 7. AMNH, ANSP. *Sphagnum*.

Cephalodella tachyphora Myers. 7, 8, 9, 11, 17. AMNH, ANSP

Cephalodella tantilla Myers. USNM, AMNH, ANSP

Cephalodella tenuior (Gosse). USNM, AMNH, ANSP

Cephalodella ventripes (Dixon-Nuttall). 4, 7, 8, 16, 19. AMNH, ANSP

Chromogaster ovalis (Bergendal). 2, 6, 7, 10, 11, 14. USNM, AMNH,
ANSP

Collothea algicola (Hudson). 6, 18

Collothea ambigua (Hudson). 18. AMNH

Collothea campanulata (Dobie). 5, 6, 8, 12, 14, 17. USNM, AMNH

Collothea coronetta (Dobie). 8

Collothea corynetis Edmondson. 8

Collothea edentata (Collins). 14

Collothea gracilipes Edmondson. 14

Collothea heptobrachiata (Schoch). 7, 8, 19

Collothea hoodii (Hudson). 19. A single specimen in 1939.

Collothea judayi Edmondson. 17. USNM, AMNH, ANSP

Collothea mutabilis (Hudson). 5. USNM, ANSP

Collothea ornata var. *cornuta* (Dobie). 5, 8, 12, 13. USNM, AMNH

Collothea trilobata (Collins). 8

Colurella adriatica Ehrenberg. 24. USNM, AMNH, ANSP

Colurella adriatica Ehrenberg, Symb. Phys. Anim. Evert., 1831, pl. 3, fig. 3.

Colurella adriatica Hauer, Geog. Ges. Natur. Mus. Lubec, vol. 30, 1925, pp. 174-177, fig. 12.

This species, also found in saline and brackish water, is probably fluvial when occurring in fresh water.

Colurella anodonta Carlin. 7, 9. AMNH, ANSP

Colurella bicuspidata (Ehrenberg). USNM, AMNH, ANSP

Colurella deflexa (Ehrenberg). 14. USNM, ANSP

Colurella denticaudata Carlin. 13. *Sphagnum*.

Colurella hindenburgi Steinecke. 7. ANSP. *Sphagnum*.

Colurella obtusa (Gosse). AMNH, ANSP

Colurella sulcata (Stenroos). 13. USNM, AMNH, ANSP

Colurella tessellata (Glasscott). 7, 8, 9, 11, 12, 17, 19. AMNH, ANSP

Conochilus hippocrepis (Schränk). 3, 7, 12, 14. USNM, AMNH, ANSP

- Conochilus unicornis* Rousselet. USNM, AMNH
Conichiloides dossuarius (Hudson). 14. USNM, AMNH, ANSP
Cupelopagus vorax (Leidy). 3, 6, 14. USNM, AMNH, ANSP
Dapidia calpidia Myers. AMNH, ANSP
Dicranophorus alcinus Harring and Myers. 13, 18. USNM, AMNH, ANSP
Dicranophorus artamus Harring and Myers. USNM, AMNH, ANSP
Dicranophorus biastis Harring and Myers. 7, 17. ANSP. *Sphagnum*.
Dicranophorus capucinus Harring and Myers. USNM, AMNH, ANSP
Dicranophorus cernuus Harring and Myers. 7. ANSP. *Sphagnum*.
Dicranophorus colastes Harring and Myers. 7, 8, 13, 16, 17, 19, 22. AMNH, ANSP
Dicranophorus corystis Harring and Myers. 5, 7, 10, 13, 17, 18. AMNH, ANSP
Dicranophorus dolerus Harring and Myers. 8. ANSP
Dicranophorus edestes Harring and Myers. 7, 17, 19. USNM, ANSP
Dicranophorus epicharis Harring and Myers. 7. USNM, AMNH, ANSP
Dicranophorus facinus Harring and Myers. 6. ANSP. *Sphagnum*.
Dicranophorus forcipatus (Müller). 2, 3, 4, 5, 6, 12, 14, 19. USNM, ANSP
Dicranophorus haueriana Wiszniewski. 6. ANSP
Dicranophorus haueriana Wiszniewski, Archiv. f. Hydrobiol., vol. 13, 1939, pp. 131-133, fig. 1.
Found among *Ranunculus trichophyllus* near breast of dam at outlet of Harvey Lake. First record for American Continent.
Dicranophorus hercules f. *intermedia* Wiszniewski. 7. ANSP. Psammbiotic
Dicranophorus isotheres Harring and Myers. 7, 11, 13, 16, 17. USNM, AMNH, ANSP
Dicranophorus lütkeni (Bergendal). 4, 7. USNM, AMNH, ANSP. *Sphagnum*
Dicranophorus prionacis Harring and Myers. USNM, AMNH, ANSP
Dicranophorus proclastes Harring and Myers. 8. AMNH. *Sphagnum*.
Dicranophorus robustus Harring and Myers. 4, 5, 6, 7, 16, 22, 23. AMNH, ANSP
Dicranophorus rostratus (Dixon-Nuttall). 7, 9, 10, 17. USNM, AMNH, ANSP
Dicranophorus saevus Harring and Myers. 17. USNM, AMNH, ANSP
Dicranophorus thysanus Harring and Myers. 7, 8, 11, 12, 17. USNM, AMNH, ANSP
Dicranophorus uncinatus (Milne). 4, 8, 11. USNM, AMNH, ANSP

Dorria dalecarlica Myers. 24. USNM, AMNH, ANSP. Pladopetric.

Dorria dalecarlica Myers, Journ. Royal Micr. Soc., vol. 53, 1933, pp. 120, 121, figs. 3, 4.

Found living among *Fontinalis dalecarlica* adhering to submerged and dripping rocks. Recorded from three locations in the United States, Mount Desert Island, Maine; mountain stream in the Adirondack Mountains, outlet of Steiner Lake, New York, and Mill Creek, Wayne Co., Pa., always in the same habitat.

Drilophaga judayi Harring and Myers. 24. USNM, AMNH, ANSP

Drilophaga judayi Harring and Myers, Trans. Wisconsin Acad. Sci. Arts, Letters, vol. 20, 1922, pp. 612-614, pl. 52, figs. 6-8.

Members of the genus *Drilophaga* are parasitic. While this species has been collected many times, always among *Sphagnum*, the host is unknown, as *D. judayi* has invariably been found free.

Elosa worallii Lord. 7. AMNH, ANSP. *Sphagnum*, Hygropsammon.

Encentrum carlini Myers. 7, 20. ANSP

Encentrum felis (Müller). 4, 6, 7, 8, 9, 17. USNM, AMNH, ANSP

Encentrum grande (Western). 23. ANSP. Synoecious on *Gammarus* sp?

Encentrum saundersiae (Hudson). 23. ANSP. *Sphagnum*.

Encentrum tobyhannaensis Myers. 20. ANSP

Enteroplea lacustris Ehrenberg. 17. USNM, AMNH, ANSP

Enteroplea lacustris Ehrenberg, Abh. Akad. Wiss. Berlin, 1830, p. 46.

Enteroplea lacustris Harring and Myers, Trans. Wisconsin Acad. Sci. Arts, Letters, vol. 21, 1924, pp. 526-528, pl. 15, figs. 1-5.

In the fall of 1915 a quantity of wet *Sphagnum* was received from the above location. This was kept in an aquarium for several months when suddenly *E. lacustris* appeared in abundance. It has not been found in the Poconos since.

Eosphora anthadis Harring and Myers. 4. USNM, AMNH, ANSP

Eothinia argus Harring and Myers. 17. USNM, AMNH, ANSP

Eothinia elongata (Ehrenberg). 6, 19. USNM, AMNH, ANSP

Eothinia eukolpa Myers. 11, 16. USNM, ANSP

Eothinia tryphaea Harring and Myers. 7, 9, 11, 19. AMNH, ANSP

Epiphanes peligica (Jennings). 19. AMNH, ANSP

Erignatha clastopis (Gosse). 7, 8, 9, 10, 13, 17. USNM, AMNH, ANSP

Euchlanis alata Voronkov. 7, 8, 9, 10, 12, 17, 19. USNM, AMNH, ANSP

Euchlanis alata Voronkov, Ann. Mus. Zool., St. Petersburg, vol. 16, 1912, p. 210.

All specimens collected were of the reduced form. Specimens from Mount Desert Island, Maine, 1921-1931, were both reduced and exuberant. This species is notable for its activity, being a restless, fast and active swimmer, while the remaining species of the genus are rather slow and stately in action.

Euchlanis dilatata Ehrenberg. USNM, AMNH, ANSP

Euchlanis incisa (Hudson and Gosse). AMNH, ANSP

Euchlanis triquetra Ehrenberg, Infusionth., 1838, p. 461, pl. 57, fig. 8.

Euchlanis triquetra Hudson and Gosse, Rotifera, vol. 2, 1889, p. 91, pl. 23, fig. 4.

Euchlanis pellucida Harring, Report Canadian Arctic Exp., vol. 8, 1921, pp. 6, 7, pl. 2, figs. 1-5.

Euchlanis incisa Carlin, Lunds Universitets Limn. Inst., N:r 2, 1939, p. 17.

Carlin points out that Ehrenberg's *Euchlanis triquetra* is actually the animal described by Harring under the name of *Euchlanis pellucida*, necessitating a new name for *Euchlanis triquetra*, for which he proposes *E. incisa* (Hudson and Gosse).

Euchlanis meneta Myers. USNM, AMNH, ANSP

Euchlanis parva Rousselet. 4, 7, 11, 12, 13, 22. AMNH, ANSP

Eudactylota eudactylotum (Gosse). 14, 17. USNM, ANSP

Filinia brachiata (Rousselet). 1. USNM, AMNH, ANSP

Filinia longiseta (Ehrenberg). 1, 4, 15. USNM, AMNH, ANSP

Filinia passa (Müller). 1. USNM, AMNH

Floscularia conifera (Hudson). 14. USNM, AMNH

Floscularia janus (Hudson). 4, 5, 7, 17. USNM, AMNH, ANSP

Floscularia pedunculata (Joliet). 12, 13, 17

Floscularia ringens (Linnaeus). USNM, AMNH

Gastropus hytopus (Ehrenberg). 19, 22. USNM, AMNH, ANSP

Gastropus minor (Rousselet). 7, 8, 18. AMNH, ANSP

Harringia rousseleti de Beauchamp. 7, 8, 19. USNM, AMNH, ANSP

Itura aurita (Ehrenberg). 3, 7, 15. ANSP

Itura chamadis Harring and Myers. 7. ANSP

Itura myersi Wulfert. 23

Itura myersi Wulfert, Archiv. f. Hydrobiol., vol. 28, 1935, pp. 589, 590, fig. 6.

This species is recognized by the presence of long subcerebral glands arising at the posterior portion of the ganglion. First record for the American Continent.

Itura viridis (Stenroos). 1, 4, 10. ANSP

Keratella cochlearis (Gosse). USNM, AMNH, ANSP

Keratella cochlearis f. *tecta* (Gosse). 1, 4, 6, 7, 13, 14. AMNH, ANSP

Keratella cochlearis var. *mixa* Oparina. 7. USNM, ANSP

Keratella crassa Ahlstrom. (nomina nudum). 4, 7, 10, 14. USNM, AMNH, ANSP

Keratella paludosa (Lucks). 10, 23. AMNH, ANSP

Keratella serrulata var. *aspina* Edmondson. USNM, AMNH, ANSP

Keratella serrulata var. *ehrenbergi* Edmondson. AMNH, ANSP

Keratella stipitata (Ehrenberg). 14. USNM, AMNH, ANSP

Keratella taurocephala Myers. 7, 11, 12. AMNH, ANSP

Kellicottia bostoniensis (Rousselet). 7, 9, 14. USNM, AMNH, ANSP

Notholca bostoniensis Rousselet, Journ. Queckett Micr. Club, vol. 10, 1908, p. 337, pl. 26, figs. 1-3; pl. 27, fig. 4.

Notholca bostoniensis Campbell, Ecological Monographs, vol. 11, 1941, p. 16.

Campbell states this is a deep-water species. This is not substantiated by the facts. The species was first found by Rousselet in a shallow body of ornamental water in Central Park, Boston, Massachusetts. It was fairly common in the littoral of Indian Lake, Lake Mineola and Pocono Lake, all bodies of shallow water.

Kellicottia longispina (Kellicott). 9. USNM, AMNH, ANSP

Lecane acronycha Harring and Myers. 9. USNM, AMNH, ANSP

Lecane acus (Harring). 7, 8, 10. *Sphagnum*.

Lecane agilis (Bryce). 6, 7, 17. AMNH, ANSP. *Sphagnum*.

Lecane aquila Harring and Myers. 7. AMNH, ANSP

Lecane arcula Harring. 6. USNM, AMNH, ANSP

Lecane bifurca (Bryce). 7, 11. AMNH, ANSP. *Sphagnum*.

Lecane brachydactyla (Stenroos). 6, 11, 13, 17. USNM, AMNH, ANSP. *Sphagnum*.

Lecane brevia new species. 8. USNM

Lecane bulla (Gosse). 4, 6, 14, 15. USNM, AMNH, ANSP

Lecane bulla f. *styrax* (Harring and Myers). AMNH, ANSP

Lecane clara (Bryce). 7, 9, 11, 16, 17, 19, 22. AMNH, ANSP

Lecane climacois Harring and Myers. 8, 11. AMNH, ANSP. *Sphagnum*.

Lecane closterocerca (Schmarda). USNM, AMNH, ANSP

Lecane constricta (Murray). ANSP

Lecane cornuta (Müller). 1, 10, 14. USNM, AMNH, ANSP

Lecane crenata (Harring). 5, 7, 10, 13. USNM, AMNH, ANSP

Lecane curvicornis (Murray). 14. AMNH, ANSP

Lecane depressa (Bryce). 3, 14. USNM, ANSP

Lecane dysorata new species. 8. ANSP

Lecane elachis (Harring and Myers). 2, 7, 9, 10, 19. USNM, AMNH, ANSP

Lecane elasma Harring. 2, 7, 8, 9. AMNH, ANSP

Lecane flexilis (Gosse). USNM, AMNH, ANSP

Lecane formosa Harring and Myers. 8. AMNH, ANSP. *Sphagnum*.

Lecane furcata (Murray). 4, 6, 7, 13. USNM, AMNH, ANSP. *Sphagnum*.

Lecane galeata (Bryce). 7, 8. *Sphagnum*.

Lecane gonita (Harring and Myers). 6. AMNH, ANSP

Lecane haliclysta Harring and Myers. 8, 19. AMNH, ANSP

Lecane hamata (Stokes). USNM, AMNH, ANSP

Lecane inermis (Bryce). 7, 10. USNM, AMNH, ANSP

Lecane inquieta Myers. 7. Psammobiotic.

Lecane intrasinuata (Oloffson). AMNH, ANSP

Lecane jessupi Harring and Myers. 11, 13. AMNH, ANSP

Lecane lauterborni Hauer. 7. ANSP. *Sphagnum*.

Lecane leontina (Turner). 2, 5, 6, 14. USNM, AMNH, ANSP

Lecane leura new species. 7. ANSP

Lecane ligona (Dunlop). 7, 8, 9, 11, 16, 17. USNM, AMNH, ANSP.
Sphagnum.

Lecane ludwigii (Eckstein). 2, 14. USNM, AMNH, ANSP

Lecane luna (Müller). 2, 4, 6, 10. USNM, AMNH, ANSP

Lecane luna var. *presumpta* Ahlstrom. 7, 13. ANSP

Lecane lunaris (Ehrenberg). USNM, AMNH, ANSP

Lecane methoria Harring and Myers. 7, 8, 12. AMNH, ANSP

Lecane mira (Murray). USNM, AMNH, ANSP

Lecane mitella Myers. 7. USNM, AMNH, ANSP. Psammobiotic.

Lecane mitis Harring and Myers. 7, 8, 11, 12. AMNH, ANSP

Lecane monostyla (Daday). 3. USNM, AMNH, ANSP

Lecane nana (Murray). 4. USNM, AMNH, ANSP

Lecane niothis Harring and Myers. 7. *Sphagnum*.

Lecane nodosa Hauer. 7. AMNH, ANSP

Lecane nodosa Hauer, Archiv. f. Hydrobiol., Supp. vol. 15, 1938, pp. 520, 521, fig. 42.

This species was first found by Hauer among *Nitella* sp? in the Botanical Gardens, Buitenzorg, West Java. First record for American Continent.

Lecane obtusa (Murray). 7. USNM, AMNH, ANSP. *Sphagnum*.

Lecane ohioensis (Herrick). 2, 4, 6, 14. USNM, AMNH, ANSP

Lecane opias (Harring and Myers). 7. ANSP. *Sphagnum*.

Lecane pedeis (Harring and Myers). 7, 11, 19. USNM, AMNH, ANSP

Lecane pelatis Harring and Myers. 7, 17, 19. USNM, AMNH, ANSP

Lecane perplexa (Ahlstrom). ANSP

Lecane pertica Harring and Myers. 7, 9, 11, 12, 13, 17, 19. USNM, AMNH, ANSP

Lecane ploenensis (Voigt). 5, 7, 9, 10, 11, 13, 17. USNM, AMNH, ANSP

Lecane psammophila (Wiszniewski). 7. Psammobiotic.

Lecane pumilla (Roussetlet). 8. AMNH, ANSP. *Sphagnum*.

Lecane pycina Harring and Myers. 6, 7. USNM, AMNH, ANSP

Lecane pyriformis (Murray). 6. USNM, AMNH, ANSP

Lecane pyrrha Harring and Myers. 7, 8, 11, 12, 16, 17. USNM, AMNH, ANSP

Lecane quadridentata (Ehrenberg). 2, 3, 4, 6, 9, 10, 14, 15. USNM, AMNH, ANSP

Lecane rhytida Harring and Myers. 11. AMNH. *Sphagnum*.

Lecane saginata Harring and Myers. 7. ANSP

Lecane satyrus Harring and Myers. 7, 8, 11. USNM, AMNH, ANSP.
Sphagnum.

Lecane scutata (Harring and Myers). 7. USNM, ANSP. *Sphagnum*.

Lecane signifera (Jennings). 5, 7, 9, 11, 13, 19. AMNH, ANSP

Lecane stichaea Harring. 2, 7, 8, 10, 11, 17, 19. USNM, AMNH, ANSP

Lecane stokesii (Pell). 4, 7. USNM, AMNH, ANSP

Lecane subtilis Harring and Myers. 7. AMNH, ANSP. *Sphagnum*.

Lecane subulata (Harring and Myers). 7. *Sphagnum*.

Lecane tenuiseta Harring. 7, 11, 19. USNM, AMNH, ANSP

Lecane thalera Harring and Myers. 5, 7, 9, 16. AMNH, ANSP

Lecane tryphema Harring and Myers. 8. AMNH, ANSP. *Sphagnum*.

Lecane unguolata (Gosse). USNM, AMNH, ANSP

Lecane unguolata var. *tenuior* (Levander). 6, 7, 9, 10, 10, 23. ANSP

Lecane verecunda Harring and Myers. 7. USNM, AMNH, ANSP.
Sphagnum.

Lepadella acuminata (Ehrenberg). AMNH, ANSP

Lepadella akrobelles Myers. 8. USNM, AMNH, ANSP. *Sphagnum*.

Lepadella apsicora Myers. 17. AMNH, ANSP. *Sphagnum*.

Lepadella apsidea Harring. 2. AMNH, ANSP

Lepadella benjamini Harring. 7, 13, 19. AMNH, ANSP

Lepadella borealis Harring. 22. AMNH, ANSP

Lepadella bractea Myers. 8, 11, 16. AMNH, ANSP. *Sphagnum*.

Lepadella cristata (Rousselet). 7, 13, 14. USNM, AMNH, ANSP

Lepadella dactyliseta (Stenroos). 8. USNM, ANSP

Lepadella eurysterna new species. 19. ANSP

Lepadella latusinus var. *americana* Myers. 8. AMNH, ANSP. *Sphagnum*.

Lepadella minuta new species. 7. ANSP

Lepadella ovalis (Müller). USNM, AMNH, ANSP

Lepadella patella (Müller). USNM, AMNH, ANSP

Lepadella quadricarinata (Stenroos). 7, 9, 23. AMNH, ANSP

Lepadella quinquecostata (Lucks). 7, 13. AMNH, ANSP

Lepadella rhomboides (Gosse). 1. USNM, AMNH, ANSP

Lepadella similis (Lucks). 18. ANSP

Lepadella triba Myers. 7, 19. AMNH, ANSP

Lepadella triptera (Ehrenberg). 2, 4, 5, 7, 10, 13. USNM, AMNH, ANSP

Lepadella triptera var. *alata* Myers. 23. ANSP

Lepadella vanefica Myers. 7, 8, 9, 11, 17, 19. AMNH, ANSP

Lepadella visenda Myers. 19. AMNH, ANSP

Lepadella whitfordi Ahlstrom. 8. AMNH, ANSP. *Sphagnum*.

Lepadella xenica Myers. 7. AMNH

Limnias ceratophylli Schrank. 2, 3, 5, 15. USNM, AMNH, ANSP

Limnias melicerta Weisse. 19. AMNH

- Lindia annecta* Harring and Myers. 7, 8, 12, 13, 17, 19, 22. AMNH, ANSP
Lindia fulva Harring and Myers. 7, 8, 19. AMNH, ANSP
Lindia pallida Harring and Myers. AMNH, ANSP
Lindia truncata (Jennings). 6. USNM, AMNH, ANSP
Lophocharis oxysternon (Gosse). 14. AMNH, ANSP
Macrochaetus collinsii (Gosse). 7, 19. USNM, AMNH, ANSP
Macrochaetus longipes Myers. 7, 18. AMNH, ANSP
Macrochaetus subquadratus Perty. 7, 11. USNM, AMNH, ANSP
Microcodin clavus Ehrenberg. USNM, AMNH, ANSP
Mikrocodides chlaena (Gosse). 6, 7, 10, 14, 16, 17. USNM, AMNH, ANSP
Monommata actices Myers. 10, 17, 19, 22. AMNH, ANSP
Monommata astia Myers. 7, 17, 22. USNM, AMNH, ANSP. *Sphagnum*.
Monommata diaphora Myers. 19. USNM, AMNH, ANSP
Monommata enedra Myers. 8, 13. USNM, ANSP. *Sphagnum*.
Monommata grandis Tessin. 6, 7, 8, 17, 22. USNM, AMNH, ANSP
Monommata hyalina Myers. 7. USNM, AMNH, ANSP
Monommata longiseta (Müller). AMNH, ANSP
Monommata maculata (Harring and Myers). AMNH, ANSP
Monommata viridis Myers. AMNH, ANSP
Mytilina ventralis (Ehrenberg). 2, 3, 4, 5, 6, 9, 10, 13, 14, 15. USNM, AMNH, ANSP
Mytilina ventralis var. *brevispina* (Ehrenberg). 4, 6, 9, 10. AMNH, ANSP
Notholca striata var. *acuminata* (Ehrenberg). 2, 15. USNM, AMNH, ANSP
Notommata aurita (Müller). 1, 4, 6. USNM, AMNH, ANSP
Notommata bennetchi new species. 2, 7. ANSP. Psammobiotic.
Notommata cerberus (Gosse). 2, 14. USNM, ANSP
Notommata cherada Myers. 17. AMNH, ANSP
Notommata codonella Harring and Myers. 6, 7, 13, 22. AMNH
Notommata contorta (Stokes). AMNH, ANSP
Notommata copeus Ehrenberg. USNM, AMNH, ANSP
Notommata cyrtopus Gosse. AMNH, ANSP
Notommata diasema Myers. 12, 18. AMNH, ANSP
Notommata doneta Harring and Myers. 7. USNM, AMNH, ANSP. *Sphagnum*.
Notommata fasciola Myers. 7, 8, 16, 22. AMNH, ANSP. *Sphagnum*.
Notommata galena Harring and Myers. 7. ANSP
Notommata lenis Harring and Myers. 7, 8, 17, 22. USNM, AMNH, ANSP
Notommata lenis Harring and Myers, Trans. Wis. Acad. Sci. Arts, Letters, vol. 22, 1922, pp. 586, 587, pl. 50, figs. 9-15.

This species, as pointed out by de Beauchamp (in litt.), has a huge pair of subcerebral glands, arising at the posterior limit of the ganglion, and extending to the anterior limit of the stomach.

Notommata pachyura (Gosse). 4, 6, 7, 9, 10, 16. AMNH, ANSP

Notommata pachyura f. *triangularis* (Kirkman). 5, 6, 7, 17, 18. USNM, AMNH, ANSP

Notommata parvida Myers. 7, 8, 19. AMNH, ANSP

Notommata peridia Harring and Myers. 12. USNM, AMNH, ANSP. *Sphagnum*.

Notommata pseudocerberus de Beauchamp. USNM, AMNH, ANSP

Notommata pygmaea Harring and Myers. 8, 17, 22. AMNH, USNM, ANSP. *Sphagnum*.

Notommata saccigera Ehrenberg. USNM, AMNH, ANSP. *Sphagnum*.

Notommata silpha Gosse. 7, 8, 11, 12, 13, 16, 17, 23. USNM, AMNH, ANSP

Notommata stitista Myers. 13. AMNH

Notommata telmata Harring and Myers. 7, 13. AMNH, ANSP

Notommata thopica Harring and Myers. 7, 10, 17. ANSP

Notommata tithasa Harring and Myers. 4, 6, 7, 11, 12, 17. USNM, AMNH, ANSP

Notommata tripus Ehrenberg. AMNH, ANSP

Notommata venusta Harring and Myers. 11, 12, 13, 17, 19. USNM, AMNH, ANSP

Pedalia mira (Hudson). 6, 8. USNM, AMNH, ANSP

Pedipartia gracilis (Myers). 7. AMNH, ANSP. *Sphagnum*.

Dicranella gracilis Myers, Amer. Mus. Novitates, no. 830, 1936, p. 7, figs. 1-3.

This species was originally collected in the hygropsammon of Lenape Lake, Atlantic County, New Jersey, and was supposed to be a psammbiotic species. It was collected amongst emerged *Sphagnum subsecundum*, growing along the North shore of Pocono Lake, during the summer of 1941, thus indicating the similarity between the two associations.

Platylas patulus (Müller). 2, 4, 6, 7, 10, 15. USNM, AMNH, ANSP

Brachionus patulus Müller, Anim. Infus., 1786, p. 361, pl. 47, figs. 14, 15.

Platylas patulus Ahlstrom, Bull. Amer. Mus. Nat. Hist., vol. 77, 1940, pp. 175, 176, pl. 19, figs. 1-4.

The few specimens of this species collected in acid water associations had long posterior spines, as had those collected in acid waters of Northern Wisconsin in 1920. Those collected in alkaline waters in the vicinity of Madison, Wisconsin and other like associations all had short posteriors.

Platylas quadricornis (Ehrenberg). 4. USNM, AMNH, ANSP

Pleurotrocha altita Myers. 10, 13, 22. USNM, AMNH, ANSP

Pleurotrocha petromyzon Ehrenberg. USNM, AMNH, ANSP

Pleurotrocha robusta (Rousselet). 7, 8, 12, 17. USNM, AMNH, ANSP
Pleurotrocha thura Myers. 5, 7, 11, 12, 16. USNM, AMNH, ANSP

Pleurotrocha vernalis Wulfert. 7. USNM, AMNH, ANSP

Pleurotrocha vernalis Wulfert, Archiv. f. Hydrobiol., vol. 28, 1935, p. 594, fig. 9.

This species, together with *P. chalicodis* Myers (1933) and *Notomata trypeta* Harring and Myers (1922) all have the same somewhat aberrant type of modified virgate trophi, the same stout body and the same long tubular foot, which is sharply set off from the body, thus forming a well marked group within the genus. First record of *P. vernalis* for the American Continent.

Ploesoma hudsoni (Imhof). 7. USNM, AMNH, ANSP

Ploesoma lenticulare (Herrick). 3, 5, 6, 7, 11, 12, 16. USNM, AMNH, ANSP

Ploesoma triacanthum (Bergendal). 7, 11, 12, 17. USNM, AMNH, ANSP

Ploesoma truncatum (Levander). 5, 7, 13. USNM, AMNH, ANSP

Polyarthra euryptera Wierzejski. 19. USNM, AMNH, ANSP

Polyarthra trigla Ehrenberg. USNM, AMNH, ANSP

Pompholyx camplanata Gosse. 2. AMNH, ANSP

Proales bemata Myers. 7, 19. AMNH, ANSP. *Sphagnum*.

Proales doliaris (Rousselet). 7, 8, 17, 19. USNM, AMNH, ANSP

Proales cognita Myers. 7, 19, 23. AMNH, ANSP

Proales fallaciosa (Harring and Myers). AMNH, ANSP

Proales sordida Hudson and Gosse, Rotifera, vol. 2, 1886, p. 37, pl. 18, fig. 7.

Proales sordida Harring and Myers, Trans. Wisconsin Acad. Sci. Arts, Letters, vol. 20, 1922, p. 605, pl. 51, figs. 9-12.

Proales fallaciosa Wulfert, Zeitschr. f. wiss., vol. 2, 1937, pp. 65-67, fig. 4.

Harring and Myers redescribed and figured a species, calling it *P. sordida* Gosse. Wulfert points out that this name had been used previously by Gosse for a different species, necessitating a new name for the species redescribed.

Proales granulosa Myers. 5, 7, 9, 12, 16, 17, 19. ANSP

Proales minima (Montet). 7, 17. USNM, AMNH, ANSP

Pleurotrocha minima Montet, Rev. Suisse Zool., vol. 23, 1915, p. 323, pl. 13, fig. 33.

Proales minima Harring and Myers, Trans. Wisconsin Acad. Sci. Arts, Letters, vol. 21, 1924, pp. 435, 436, pl. 20, figs. 1-4.

This species was collected amongst emerged *Sphagnum subsecundum* growing along the North shore of Pocono Lake during the summer of 1941. It was also collected in the hygrosummon of the same body of water, again pointing out the similarity between the two associations.

Proales ornata Myers. 18, 19. *Sphagnum*.

Proales palimmeka Myers. 7, 18. AMNH, ANSP

Proales parasita (Ehrenberg). 4, 6, 7. AMNH, ANSP

Proales sordida Gosse. AMNH, ANSP

Proalinopsis caudatus (Collins). 7, 13, 20, 21. USNM, AMNH, ANSP

Proalinopsis gracilis Myers. 7, 17. AMNH, ANSP

Proalinopsis phacus Myers. 7, 8. *Sphagnum*.

Proalinopsis squamipes Hauer. 23. AMNH, ANSP

Proalinopsis squamipes Hauer, Naturwiss. Ver. Karlsruhe, vol. 31, 1935, pp. 99, 100, fig. 26.

In November 1926, Mr. David Bryce stated (in litt.) that he had found a strange rotifer from North Fort, England, enclosing a sketch and description. He called the rotifer *Proalinopsis antenigera*. His ill health and ultimate death prevented publication of the new species. Hauer figured and described an identical species which he found in a moor in the Black Forest, Germany. Since then it has been collected amongst aquatic Bryophytes in pladopetric associations in a stream near Fort Johnson, New York, and a creek near Absecon, New Jersey. A new record for the American Continent.

Proalinopsis staurus Myers. 7, 17. USNM, AMNH, ANSP

Pseudoeocistes rotifer Stenroos. 5, 7, 12, 13, 17, 18, 19. USNM, AMNH, ANSP

Pseudoploesoma formosum (Myers). 7, 8, 11, 12. USNM, AMNH, ANSP. *Sphagnum*.

Ptygura barbata Edmondson. 8, 11, 17. AMNH, ANSP

Ptygura beauchampia Edmondson. 3, 5, 7, 8, 11, 17. AMNH, ANSP

Ptygura brachiata (Hudson). 3, 5, 6, 7, 8, 11, 12. USNM, ANSP

Ptygura crystallina (Ehrenberg). 8, 11, 19. AMNH, ANSP

Ptygura libera Myers. 2. AMNH, ANSP

Oecistes species? Rousselet, Journ. Queckett Micr. Club, vol. 10, 1908, pp. 338, 339.

Ptygura libera Myers, Journ. Royal Micr. Soc., vol. 54, 1934, pp. 15, 16, fig. 1.

Originally incompletely described by Rousselet who did not give it a name. He found it in the same body of ornamental water in Central Park, Boston, Massachusetts, in which he originally found *Kellicottia bostoniensis*. Harring and Myers refound it in Fowler Lake, Wisconsin, in 1916, and Edmondson in two New Hampshire lakes in 1938.

Ptygura longicornis (Davis). 7. ANSP

Ptygura longipes (Wills). 3, 18. ANSP

Ptygura melicerta var. *mucicola* (Kellicott). 5, 6, 18. AMNH, ANSP

Ptygura velata (Gosse). 17, 18. AMNH

Resticula anceps Harring and Myers. 13. AMNH, ANSP

Resticula melandocus (Gosse). 4, 6, 7, 8, 12, 17, 22. USNM, AMNH, ANSP

Resticula nyssa Harring and Myers. 7, 19, 23. USNM, AMNH, ANSP

Rousseletia corniculata Harring. 7, 8, 10, 12, 16, 17, 19. AMNH, ANSP
Scaridium longicaudum (Müller). USNM, AMNH, ANSP
Sinantherina aripripes Edmondson. 18. USNM, AMNH, ANSP
Squatinella bifurca (Hudson). 7, 8. *Sphagnum*.

Squatinella leydigii (Zacharias). 7, 8.

Squatinella longispinus Tatem, Quart. Journ. Mic. Sci., vol. 7, 1867, p. 252, pl. 10, figs. 1-3.

Stephanops leydigii Zacharias, Zool. Anz., vol. 9, 1886, p. 318.

Harring (1913) lists this rotifer as a synonym for *S. longispina*. There is no doubt that they are distinct species. *Squatinella leydigii* is a much larger, more robust animal. Its foot consists of a short basal and a long terminal joint; toes long. There is no dorsal spine projecting from the posterior limit of the terminal foot joint. Besides being a much smaller animal, the foot of *S. longispina* consists of a long basal and a short terminal joint; toes short. There is also a distinct dorsal spine emerging from the posterior limit of the terminal foot joint. (Plate 25, figs. 8, 9.)

Squatinella longispina (Tatem). 5, 6, 7, 8, 9, 11, 18, 22. AMNH, ANSP

Squatinella mutica (Ehrenberg). USNM, AMNH, ANSP

Squatinella tridentata (Fresenius). 2. USNM, AMNH

Squatinella retrospina Myers. 7, 8, 11, 17, 22. ANSP. *Sphagnum*.

Stephanoceros fimbriatus (Goldfuss). 4, 9, 14, 17. USNM, AMNH, ANSP

Stephanoceros millsii (Kellicott). 8, 13. USNM, ANSP

Streptognatha lepta Harring and Myers. 8, 11, 16, 17. AMNH, ANSP.
Sphagnum.

Synchaeta longipes Gosse. 3, 4, 5, 6, 7, 14. USNM, AMNH, ANSP

Synchaeta oblonga Ehrenberg. 6, 7. USNM, AMNH, ANSP

Synchaeta pectinata Ehrenberg. 2, 3, 7, 11, 16. USNM, AMNH, ANSP

Synchaeta stylata Wierzejski. 7. USNM, AMNH, ANSP

Synchaeta tremula (Müller). 4. USNM, AMNH, ANSP

Taphrocampa annulosa Gosse. USNM, AMNH, ANSP

Taphrocampa clavigera Stokes. 7. AMNH, ANSP

Taphrocampa selenura Gosse. 6, 16, 19, 22. USNM, AMNH, ANSP

Testudinella angulata Myers. 7, 9, 11, 12, 17. USNM, AMNH, ANSP

Testudinella armiger new species. 7, 8, 18. AMNH, ANSP

Testudinella aspis Carlin. 7, 8, 12, 17, 22. AMNH, ANSP. *Sphagnum*.

Testudinella caeca (Parsons). 7, 8, 17. AMNH, ANSP

Testudinella dicella Myers. 7, 9, 13, 16, 17, 19, 23. AMNH, ANSP

Testudinella emarginula Carlin. 7, 8, 19. AMNH, ANSP

Testudinella epicopta Myers. 8, 17. AMNH, ANSP. Synoecious on *Acantholeberis curvirostris*.

Testudinella incisa (Ternetz). 4, 6, 7, 9, 11, 13, 17, 19, 22. USNM, AMNH, ANSP

- Testudinella naumanni* Carlin. 7, 8, 12. *Sphagnum*.
Testudinella parva (Ternetz). USNM, AMNH, ANSP
Testudinella parva var. *bidentata* (Ternetz). AMNH, ANSP
Testudinella patina (Hermann). 2, 3, 4, 6, 7, 10, 13, 14, 23. USNM, AMNH, ANSP
Testudinella patina var. *intermedia* (Anderson). 2, 3, 4, 13, 14, 19, 23. USNM, AMNH, ANSP
Tetrasiphon hydrocora Ehrenberg. 7, 8, 10, 13. USNM, AMNH, ANSP
Trichocerca bicristata (Gosse). 7, 13, 14, 23. USNM, AMNH, ANSP
Trichocerca bicuspes (Pell). 4, 6, 14, 19. USNM, AMNH, ANSP
Trichocerca bidens (Lucks). AMNH, ANSP
Trichocerca brachyura (Gosse). USNM, AMNH, ANSP
Trichocerca capucina (Wierzejski). 7. USNM, AMNH, ANSP
Trichocerca cavia (Gosse). 4, 6, 7, 13, 23. AMNH, ANSP

Trichocerca collaris (Rousselet). USNM, AMNH, ANSP

Rattulus collaris Rousselet, Journ. Queckett Micr. Club, vol. 6, 1896, p. 266, pl. 11, fig. 1.
Diurella collaris Jennings, Bull. U. S. Fish Comm., vol. 22, 1903, p. 319, pl. 14, fig. 127.

Two forms of this species are common and constant throughout the region, a large and a smaller. The smaller form is only two-thirds the length of the larger. Large individuals, body 310 μ ; toes 135 μ .

- Trichocerca cylindrica* (Imhof). 5, 7. AMNH, ANSP
Trichocerca elongata (Gosse). 2, 3, 4, 6. USNM, AMNH, ANSP
Trichocerca fusiformis (Levander). USNM, AMNH, ANSP

Trichocerca gracilis (Tessin). 4, 7, 15. ANSP

Mastigocerca iernis Gosse, Journ. Royal Micr. Soc., 1887, p. 866, pl. 15, fig. 3.
Acanthodactylus gracilis Tessin, Arch. Naturg. Mecklenburg, vol. 43, 1890, p. 155, pl. 2, fig. 14.
Trichocerca compressa Edmondson, Trans. Amer. Micr. Soc., vol. 57, 1937, p. 153, pl. 1, figs. 3, 4.

Neither Gosse nor Tessin saw or mentioned the presence of a frontal mucro in *Mastigocerca iernis* or *Acanthodactylus gracilis*. *Trichocerca compressa* has no trace of one.

We cannot disregard their not mentioning it by stating it is easily overlooked on account of its small size, as it is perfectly obvious in contracted specimens.

Bilfinger (1894, loc. cit.) noted a species which he called *Mastigocerca iernis* in which he stated a frontal mucro to be present.

Edmondson (1936, loc. cit.) described a similar species having two frontal mucrones, naming it *Trichocerca rossae*.

As with other species of the genus, all of the above vary somewhat in length. The several characters which they have in common are: the small head-sheath, the very stout right toe, which is generally held at an obtuse

angle with the left, and the two prominent ventral folds of the head-sheath (Plate 23, fig. 7). The dorsal ridge, as in other species of the genus, varies in length and height and is of little taxonomic value.

Trichocerca harveyensis new species. 6. USNM

Trichocerca inermis (Linder). 4. USNM, ANSP

Trichocerca insignis (Herrick). 2, 3, 4, 6, 7, 11, 13, 17, 19. AMNH, ANSP

Trichocerca intermedia (Stenroos). USNM, AMNH, ANSP

Trichocerca lata (Jennings). 4, 6, 7, 17. AMNH, ANSP

Trichocerca longiseta (Schrank). USNM, AMNH, ANSP

Trichocerca lophoessa (Gosse). 5, 7, 10, 13, 16, 17, 19, 23. USNM, AMNH, ANSP

Trichocerca microcornis (nom. nov.)

(non) *Mastigocerca iernis* Gosse, Journ. Royal Micr. Soc., 1887, p. 866, pl. 15, fig. 3.

Bilfinger (Jahresh. Ver. Vaterl. Naturk., vol. 50, 1894, p. 49) wrongly assigned this species to *Mastigocerca iernis* Gosse, therefore a new name is necessary.

Trichocerca mollis Edmondson. 7, 8, 11, 13, 17. USNM, ANSP

Trichocerca mucosa (Stokes). USNM, AMNH, ANSP

Trichocerca multicrinis (Kellicott). 7. USNM, AMNH, ANSP

Trichocerca musculus (Hauer). 5, 7, 12, 13, 17. ANSP

Trichocerca ornata Myers. 7, 17, 19. USNM, AMNH

Trichocerca platessa Myers. 7, 9, 11, 12, 13, 17, 19. USNM, AMNH, ANSP

Trichocerca porcellus (Gosse). USNM, AMNH, ANSP

Trichocerca porcellus var. *major* (Hauer). 3, 6, 7, 9, 13, 16, 17, 19. AMNH, ANSP

Trichocerca pusilla (Jennings). 1, 2, 5, 7, 13. USNM, AMNH, ANSP

Trichocerca rattus (Müller). USNM, AMNH, ANSP

Trichocerca rattus var. *cristata* (Ehrenberg). 13, 14, 15. ANSP

Trichocerca rattus var. *minor* Fedeev. 3, 7, 13, 17, 19. ANSP

Trichocerca rattus var. *minor*, Fedeev, Trav. Soc. Nat. Charkow, vol. 50, 1925, p. 10, figs. 10-12.

All individuals observed in acid water of the above two varieties had a very low dorsal ridge. It seems the ridge reaches its greatest development in alkaline water associations.

Trichocerca rosea (Stenroos). 4, 7, 8, 11, 12, 13, 16, 19. ANSP

Trichocerca rossae Edmondson. 7, 17. AMNH, ANSP

Trichocerca rotundata Myers. 7, 8, 11, 16, 17, 22. AMNH, ANSP

Trichocerca rousseleti (Voigt). 7. AMNH, ANSP

Diurella rousseleti Voigt, Zool. Anz., vol. 25, 1902, p. 38.

Diurella rousseleti Jennings, Bull. U.S. Fish Comm., vol. 22, 1903, p. 315 pl. 4, figs. 37-39.

This species was found only amongst *Nitella flexilis* in Pocono Lake at a depth of about six feet, where it was common.

Trichocerca scipio (Gosse). USNM, AMNH, ANSP

Mastigocerca scipio Gosse, Rotifera, vol. 2, 1886, p. 61, pl. 20, fig. 11.

Rattulus scipio Jennings, Bull. U. S. Fish Comm., vol. 22, 1903, p. 322, pl. 5, figs. 50-52; pl. 13, figs. 111, 112.

One of the most abundant species in the region. There are two forms; a large, slender form, and a smaller, stout form. The smaller form is about two-thirds the length of the larger. The dorsal ridge varies in length and in height. Large specimens, body 290 μ ; left toe 222 μ .

Trichocerca similis (Wierzejski). AMNH, ANSP

Trichocerca sulcata (Jennings). 2, 5, 7, 9, 12, 13. AMNH, ANSP

Trichocerca tenuior (Gosse). USNM, AMNH, ANSP

Trichocerca tigris (Müller). AMNH, ANSP

Trichocerca tortuosa (Myers). 7, 8, 9, 11, 12, 13, 17, 19. AMNH, ANSP

Trichocerca uncinata (Voigt). 5, 7, 19. AMNH, ANSP

Trichocerca vernalis (Hauer). 7, 19. ANSP

Diurella vernalis Hauer, Zool. Anz., vol. 115, 1936, pp. 334-336, fig. 1.

This species resembles *Trichocerca weberi* (Jennings) at first glance so closely that it is possible it may have been previously mistaken for that species. First record for American Continent.

Trichocerca weberi (Jennings). 2, 3, 4, 6, 7, 15. USNM, AMNH, ANSP

Trichotria eukosmeta Myers. 7. USNM, AMNH, ANSP. Psammobiotic.

Trichotria longipedis new species. 16. ANSP

Trichotria similis (Stenroos). 3, 6, 7, 10. USNM, ANSP

Trichotria tetractis (Ehrenberg). USNM, AMNH, ANSP

Trichotria tetractis var. *caudata* (Lucks). 7, 8, 11, 21. AMNH, ANSP

Trichotria truncata (Whittlegge). 7, 11, 17. USNM, AMNH, ANSP

Tylotrocha monopus (Jennings). 5, 7, 8, 9, 10, 11, 13, 17. AMNH, ANSP

Wierzejskiella elongata (Glasscott). 7. ANSP. *Sphagnum*.

Wierzejskiella velox Wiszniewski. 7. AMNH. Hygropsammon.

ORDER BDELLOIDEA

Adineta barbata Janson. 7. ANSP. *Sphagnum*.

Adineta gracilis Jansen. 7. ANSP. *Sphagnum*.

Adineta vaga (Davis). 7. *Sphagnum*.

Dissotrocha aculeata (Ehrenberg). USNM, AMNH, ANSP

Dissotrocha macrostyla (Ehrenberg). AMNH, ANSP

Embata commensalis (Western). 20, 23. USNM, AMNH, ANSP. Synoecious on *Gammarus* sp?

Habrotrocha ampula Murray. 7. ANSP. *Sphagnum*.

Habrotrocha angusticollis (Murray). 7. USNM, AMNH, ANSP. *Sphagnum*.

Habrotrocha collaris (Ehrenberg). 7. *Sphagnum*.

Habrotrocha constricta (Duzardin). 7. *Sphagnum*.

Habrotrocha lata (Bryce). 7. ANSP. *Sphagnum*.

Habrotrocha munda Bryce. 7. ANSP

Habrotrocha reclusa (Milne). 7. ANSP. *Sphagnum*.

Macrotrachela reclusa Milne, Proc. Philos. Soc. Glasgow, vol. 20, 1889, p. 50, fig. 1.

This species lives in the retort cells of *Sphagnum subsecundum*. It feeds by projecting its head through the terminal pore of the cell; it then expands its corona starting ciliary action, thus creating currents that bring particulate matter, on which it feeds, to the mouth. It deposits its egg within the cell. When the young hatch there are two rotifers in the same cell. As there is only one pore from which to feed, one rotifer must vacate. It then searches for an unoccupied retort cell which it enters through the pore.

Macrotrachela concinna (Bryce). 7. *Sphagnum*.

Macrotrachela cruciformis (Murray). 7. *Sphagnum*.

Macrotrachela ehrenbergi (Jansen). 7.

Macrotrachela habita (Bryce). ANSP. Pocono Lake Preserve. Tree moss.

Macrotrachela multispinosa Thompson. AMNH, ANSP. Tree moss.

Macrotrachela musculosa (Milne). 7. *Sphagnum*.

Macrotrachela plicata (Bryce). AMNH, ANSP. Tree moss.

Macrotrachela quadricornifera Milne. 7. USNM, ANSP. *Sphagnum*.

Mnioba tetradon (Ehrenberg). 7. Tree moss.

Philodina citrina Ehrenberg. AMNH

Philodina megalotrocha Ehrenberg. AMNH

Philodina megalotrocha Ehrenberg, Abh. Akad. Wiss., 1832, p. 148.

While the last two species were fairly common throughout the Plateau, they were especially abundant in water the pH of which was above 6.8.

Philodina plena (Bryce). ANSP. Tree moss.

Pleuretra brycei (Weber). 7. *Sphagnum*.

Scepanotrocha rubra Bryce. 7. *Sphagnum*.

Rotaria macrura (Ehrenberg). USNM, AMNH, ANSP

Rotaria ovata (Anderson). 8. *Sphagnum*.

Actinurus ovatus Anderson, Journ. Asiatic Soc. Bengal, vol. 58, 1889, p. 351, pl. 20, fig. 6.

While this species bears a superficial resemblance to *Rotaria macrura* (Ehrenberg), it is much smaller. It is invariably encased in a pronounced gelatinous investment, and lives in very acid water associations.

Rotaria rotatoria (Pallas). USNM, AMNH, ANSP

Rotaria sordida (Western). AMNH

Rotaria tardigrada (Ehrenberg). AMNH

New Species Described

The following new species are herein described:

<i>Aspelta chorista</i>	<i>Trichotria longipedis</i>
<i>Cephalodella asarcia</i>	<i>Lepadella eurysterna</i>
<i>Cephalodella montana</i>	<i>Lepadella minuta</i>
<i>Cephalodella sabulosa</i>	<i>Lecane brevitata</i>
<i>Cephalodella subsecunda</i>	<i>Lecane dysorata</i>
<i>Notommata bennetchi</i>	<i>Lecane leura</i>
<i>Trichocerca harveyensis</i>	<i>Testudinella armiger</i>

Types are in the collection of The Academy of Natural Sciences of Philadelphia.

Family DICRANOPHORIDAE***Aspelta chorista* new species²**

Plate 23, figs. 4, 6.

Body elongate, nearly parallel-sided, transparent. Head long, separated from abdomen by a well marked fold. Corona nearly prone, with prominent lateral auricle-like tufts of long cilia. Rostrum strongly decurved, broad at base, rounded anteriorly. Integument with longitudinal divisions. The oblique circular fold which limits the cuticular plates is well-marked. Foot fairly large and conical. Toes long, slender, gradually diminishing in depth, ending in slender slightly decurved tips. Foot glands long and stout.

Mastax large, of the forcipate type. Rami lyrate, fairly slender, terminating in blunt tips; fulcrum about one-half the length of the rami; unci rudimentary, asymmetric, of irregular shape, the right being reduced to a short stout rod; the left is composed of three branches; one resting on the manubrium, the others lying against the ramus.

Ganglion long and saccate. Retrocerebral sac present. Eyes absent.

Length of body 128 μ ; ties 32 μ ; trophi 30 μ .

Encentrum chorista was collected among *Drepanocladus exannulatus* in Pocono Pond during September 1941. It bears a superficial resemblance to other members of the genus, but can be readily distinguished by the prominent longitudinal divisions of the integument, the long toes and the very simple trophi, resembling that of *Aspelta circinator* (Gosse).

Family NOTOMMATIDAE***Cephalodella asarcia* new species**

Plate 23, fig. 5.

Body very elongate and parallel-sided. Head long, convex anteriorly; without projecting lips. Lorica thin, flexible. Plates ill-defined; lateral clefts evanescent. Foot robust, conical. Toes straight, deep at base, from whence they diminish gradually to very acute tips. Foot glands large, pyriform. Corona frontal anteriorly, from thence extending down the ventral side one-fourth the entire length of the body.

² All characters not mentioned in the descriptions of species should be considered as normal.

Mastax of modified virgate type peculiar to the genus. Manubria slender straight rods. Gastric glands small, oval. Ganglion extremely long and saccate. Eyespot absent.

Length of body 80 μ ; toes 15 μ .

Cephalodella asarcia was collected amongst detached and floating *Myriophyllum humile* along the South shore of Twin Lakes during the summer of 1941. While it bears a superficial resemblance to *C. elongata* Myers, it lacks the double frontal eyespot of that species. It differs from all known species by the structure of the corona which is frontal for half its length, then prone for the ventral two-thirds.

***Cephalodella montana* new species**

Plate 23, fig. 3.

Body elongate, cylindric and somewhat swollen posteriorly. Head long, convex anteriorly; without projecting lips. Lorica thin, flexible. Plates ill-defined; lateral clefts narrow, parallel-sided. Foot stout, conical. Toes short, straight, tapering gradually, ending in acute tips. Foot glands large, pyriform. Corona very convex, sub-prone.

Mastax of modified virgate type. Manubria strongly crutched at distal ends. Gastric glands small, round. Ganglion long and saccate. Eyespot absent.

Total length 135 μ ; toes 20 μ .

Cephalodella montana was collected among *Ceratophyllum demersum* and *Potamogeton vaginatus* in Mountain Lake, near Marshalls Creek, Pike County, during the summer of 1941. It bears some resemblance to *C. elongata* Myers, but differs from that species by the absence of a frontal eyespot; the crutched manubria; the sub-prone corona and the straight toes.

***Cephalodella sabulosa* new species**

Plate 23, fig. 2.

Body deep, gibbous dorsally and strongly compressed laterally. Head rather small, without projecting lips; neck well-marked. Integument quite rigid; lateral clefts close together. Foot short, conical. Toes long, stout and parallel-sided, ending in acute tips. Corona almost frontal.

Mastax of modified virgate type. Posterior half of manubria curves sharply dorsally forming a semicircle. Ganglion short, saccate, with a round eyespot situated at the posterior end.

Length of body 90 μ ; toes 36 μ .

Cephalodella sabulosa was collected in the hygrosummon on the South shore of Pocono Lake during August 1941.

As in a number of psammobiotic rotifers, the body is strongly compressed laterally, an adaptation to the environment in which they live. The compressed body, the stout toes, and the different associations in which it lives are sufficient to distinguish this species from *C. compressa* Myers, its nearest relative.

***Cephalodella subsecunda* new species**

Plate 23, fig. 1.

Body stout, cylindric. Head quite large, without projecting lips. Neck sharply set off by a constriction. Abdomen evenly arched dorsally. There

is a hyaline round area of high refractive index on each side of the body in the position of the lateral antennae. Integument firm; plates distinctly marked; clefts flaring posteriorly. Foot short and conical. Toes long, recurved for half their length, from thence slightly decurved, gradually diminishing and ending in very slender tips. Corona sub-prone and strongly convex anteriorly.

Mastax large, of modified virgate type. Manubria reduced to slender rods, the posterior half curving sharply dorsally in the form of a semicircle. Ganglion long, saccate, carrying a round eyespot attached to the posterior end.

Length of body 90 μ ; toes 40 μ .

Cephalodella subsecunda was collected among emersed *Sphagnum subsecundum* along the North shore of Pocono Lake during the summer of 1941.

It is related to *C. tantilla* Myers, from which it differs by the sub-prone corona, the evenly arched abdomena, the different shape of the toes, and the round hyaline areas in the lumbar region.

The hyaline areas are present in only one other genus of rotifers. *Monommata grandis* (Tessin) and *M. actices* Myers have round areas in the same position, but in these rotifers they are of a bright red color, while those of *C. subsecunda* are clear but very distinct.

Notommata bennetchi new species

Plate 24, figs. 4-9.

Body short and stout, evenly arched and gradually diminishing toward the toes. There is no distinct line of demarcation between the head and abdomen, the extremities of the trunk appearing to be superficially annulate. The toes are very stout, enlarged at the base and slightly decurved. There is no true foot present. The corona extends down the ventral side about one-fourth the length of the body. The auricles are very small.

The mastax may be considered as belonging to the virgate type, but the pumping action has been virtually lost. The trophi are asymmetric and robust. The fulcrum is a relatively short plate, expanded at the base, in ventral aspect, and without any posterior enlargement for attachment of the hypopharynx. In ventral aspect, the left ramus has a blunt projection in its inner margin. The alulae are unequally developed, the right being very large; it arises some distance from the tip of the ramus and ends in a drawn-out acute tip. The left alula is a lamellar plate extending the entire length of the ramus. Its anterior margin is excavate, forming a round projection at the outer angle on which the ventral tooth of the uncus rocks. The unci each have a subsquare basal plate to which is attached a very stout, strongly developed ventral tooth, having a large pre-uncial tooth attached to its ventral margin. This is followed by a smaller second tooth which, in turn, is followed by two extremely slender rudimentary teeth. The anterior portion of the manubria have a characteristic ventral hook; the dorsal cell is long, lamellar and rounded anteriorly. A pair of straight epipharyngeal rods are attached by their ventral ends to the inner surface of the rami.

The ganglion is small and saccate. The retrocerebral organ is greatly developed. The sac is ductless and relatively long; it is sometimes of a

reddish tint and has a number of bacterioids clustered in the distal portion. The subcerebral glands reach the greatest development of any species in the genus, being nearly half the entire length of the body and faintly vacuolate. The eyespot is situated at the posterior end of the ganglion and is slightly ventrally placed.

Total length 165–212 μ ; toes 24–24 μ ; trophi 34 μ .

Notommata bennetchi was originally collected in the hygropsammon on the East shore of Poponoming Lake in August 1940, by Mr. Leonard M. Bennetch, of Bethlehem, Pa., to whom the species is dedicated. It was refound in August 1941 in the hygropsammon on the South shore of Pocono Lake. It is the only psammobiotic species of the genus.

It is reasonable to suppose that the rounded anterior projection of the left alula represents the first stage in the development of the sub-uncial rod in some species of the genus *Trichocerca*, one end of which rests on the left alula while the uncus rocks on the other end. (See Plate 25, fig. 10.)

This species is placed in the genus *Notommata* with some hesitation. The pumping function of the mastax has virtually disappeared. Yet, there are so many structural characters indicating its derivation, it is thought advisable to leave it in that genus.

Notommata bennetchi is related to *N. tripus* (Ehrenberg). It differs from that species principally by the structure of the trunk, the absence of a tail, the details of the trophi, huge subcerebral glands and different habitat.

***Trichocerca harveyensis* new species**

Plate 24, fig. 13; pl. 25, fig. 10.

Body elongate; conical in lateral aspect; cylindric and gradually tapering at both ends, in dorsal aspect. Head short, having only a few cuticular folds and one prominent mucro, dorsally placed. The striated area extends backward over one-half the length of the body; transverse striations distinct. Foot conical. Left toe about one-half the length of the body; right toe about one-ninth. There is one small substyle.

The mastax is of modified virgate type peculiar to the genus, the trophi being highly asymmetric. The right malleus is atrophid and bacillar, the left being very robust and strongly curved distally. The left uncus is provided with a single stout tooth. Attached to its middle portion is a long slender rod, the distal tip of which rests on the left alula. The right subuncus is composed of five or six short needle-like teeth. The rami are roughly triangular. The right alula is prolonged posteriorly; the left is much longer, and the distal portion is drawn out into a long, acute tip. The fulcrum is very long and strongly expanded posteriorly.

Length of body 180 μ ; left toe 90 μ ; right toe 20 μ ; trophi 40 μ .

Trichocerca harveyensis was collected among *Fontinalis disticha* in shallow water along the shore of a small bay near the outlet of Harvey Lake, during the summer of 1941. It resembles *T. microcornis* (Bilfinger) somewhat in dorsal aspect. In lateral view the resemblance ceases, as the lorica

is wide open in front and very deep, as in *T. scipio* (Gosse). From that point it diminishes gradually to the foot, giving the animal a characteristic conical appearance, as in *T. similis* (Wierzejski).

Family BRACHIONIDAE

Trichotria longipedis new species

Plate 24, fig. 2.

Lorica somewhat flexible; widely ovate in shape and truncate anteriorly. In lateral aspect, the body falls away suddenly, and diminishes greatly in depth near the posterior limit. The breadth is nearly equal to the length. Dorsum vaguely punctate; it has the usual central elevation but is without any indication of definite plates or marginal spines. Foot composed of two approximately equal joints. Toes very long, slender and parallel-sided.

Total length 240 μ ; toes 80 μ .

Trichotria longipedis was collected among *Elodea occidentalis* growing along the West shore of Promised Land Lake during the summer of 1940.

It differs from the remaining species of the genus by the wide, thin lorica and the exceptionally long, slender toes. While *T. similis* (Stenroos) has long toes, the dorsum is provided with the usual carinal plates and ridges, and is relatively long and narrow. The penultimate foot joint of that species is very long, being about equal to one-third the length of the lorica. *T. similis* is also a much larger animal reaching a total length of over 500 μ .

Lepadella eurysterna new species

Plate 25, fig. 3.

Body pyriform. Dorsal plate evenly arched in cross-section, posterior third pinched in on each side of foot groove. Lateral antennae emerge from minute tubules. Foot groove narrow, parallel-sided. Terminal foot joint about equal in length to the combined length of the first and second. Toes long, diminishing rather rapidly, ending in slender, drawn-out tips.

Length of lorica 90 μ ; foot groove 27 μ ; toes 32 μ . Depth of dorsal sinus 15 μ ; ventral sinus 18 μ . Width of lorica 66 μ ; anterior points 24 μ .

Lepadella eurysterna was collected among submerged *Fontinalis Novae-Angliae* clinging to stumps along the shore of Naomi Lake, during the summers of 1939, 1940 and 1941. Its nearest relatives are *L. xenica* Myers and *L. whitfordi* Ahlstrom. In those species the dorsal plate is provided with ridges, while in *L. eurysterna* it is evenly arched, there being no indication of ridges. It also differs from those species by the lateral antenna which emerge from tubules instead of the normal round openings in the lorica.

Lepadella minuta new species

Plate 25, fig. 2.

Body oval in outline, evenly arched dorsally in cross-section. The posterior third of the dorsal plate is pinched in and ends posteriorly in a blunt point. Anterior dorsal margin roundly excavate; mental margin deep and broadly V-shaped. Foot groove wide, parallel-sided. Terminal foot joint

equal to the combined length of the first and second joints. Toes rather stout at the base from where they taper abruptly to long, slender tips.

Length of lorica $60\ \mu$; dorsal sinus $8\ \mu$; central sinus $20\ \mu$; foot groove $18\ \mu$; toes $20\ \mu$. Width of lorica $56\ \mu$; anterior points $21\ \mu$.

Lepadella minuta was collected among emerged *Sphagnum subsecundum* growing along the north shore of Pocono Lake during the summer of 1941. It was not found elsewhere.

This species is closely related to *L. venefica* Myers, from which it differs by the shape of the frontal margins of the lorica; the pinched-in portion of the posterior third of the dorsal plate, and the more slender, relatively longer toes.

Lecane brevit new species

Plate 25, fig. 1.

Lorica broadly ovate. Anterior margins nearly coincident; the dorsal very slightly concave, the ventral slightly convex in the central portion. Dorsal plate without surface markings; rounded posteriorly. Ventral plate somewhat narrower than the dorsal. Posterior segment rather small and rounded, projecting beyond the dorsal plate. Coxal plates are quite prominent and subsquare. First foot joint wide, distinct; second, large and broad. Toe long, stout at base, tapering and ending in a long double claw, the two parts of which are distinctly separated.

Length of dorsal plate $60\ \mu$; ventral plate $66\ \mu$; toe $24\ \mu$; claw $8\ \mu$. Width dorsal plate $56\ \mu$ ventral plate $48\ \mu$; anterior points $42\ \mu$.

Lecane brevit was collected among *Sphagnum cuspidatum* and *Utricularia vulgaris* in Tamaque Lake during August 1939. It has not been found since. It is related to that assemblage of small *Lecanes* inhabiting wet *Sphagnum* such as, *L. opias* Haring and Myers, *L. subulata* Haring and Myers, and *L. obtusa* (Murray). It is readily distinguished from other species of the genus by the frontal margins, together with the shape of the toe and especially by the long, separated claws.

Lecane dysorata new species

Plate 25, fig. 6.

Lorica thin, flexible, but sufficiently firm to assume a definite form when completely contracted. Outline of body subcircular; width about equal to the length. Anterior margin straight, the dorsal and ventral edges failing to meet in complete contraction, the dorsal margin being generally higher than the ventral in the middle portion. First foot joint, obscure; second joint subsquare. Toe of medium length, stout, parallel-sided for about two-thirds of its length then tapering gradually towards the tip; claw absent, but the tip of the toe has a median line or indistinct groove.

Total length $60\ \mu$; toe $15\ \mu$.

Lecane dysorata was collected among immersed *Sphagnum cuspidatum* along the margin of Half-moon Pond, Monroe County, and Lake Tamaque during the summers of 1939 and 1941. It bears some resemblance to that assemblage of small soft-bodied *Lecanes* of the *Monostyla* group, which

include *L. crypta* (Hauer) and *L. bifurca* (Bryce). It differs from them both by being more robust, by the anterior margin, and in the formation of the toe, especially the tip. The coxal plates do not project as in *L. bifurca*.

***Lecane leura* new species**

Plate 25, fig. 5.

Lorica elongate oval. Anterior margins coincident, straight, with two small cusp-like spines, one at each angle. Dorsal plate slightly truncate posteriorly; surface markings shallow, indistinct. Ventral plate somewhat narrower than the dorsal; posterior segment prominent, projecting beyond the foot. First foot joint indistinct; second large, pyriform. Toes long, extremely slender, parallel-sided, shouldered and clawed.

Length, dorsal plate 87 μ ; ventral plate 99 μ ; toes 33 μ ; claws 7 μ . Width, dorsal plate 72 μ ; ventral plate 64 μ ; anterior points 54 μ .

Lecane leura was collected among detached and floating *Eleocharis acicularis* in Pocono Lake, 1941, and in Lake Bala, Ontario, 1939. It bears some resemblance to *L. ploenensis* (Voigt). The absence of distinct faceting on the dorsal plate, the very slender toes, and especially the presence of claws, distinguish it from that species at once.

Family **TESTUDINELLIDAE**

***Testudinella armiger* new species**

Plate 25, figs. 4, 7.

Lorica elongate oval, truncate anteriorly, obscurely pointed posteriorly. Dorsal anterior margin raised in the middle portion, at the summit of which is a deep narrow V-shaped median notch; mental margin somewhat excavate. There is a distinct neck region with a collar arising at the sides of the dorsal margin and projecting on the ventral side. The lateral antennae are protected by an overlapping of the lateral margins of the lorica; they are situated high up on the shoulders. The foot opening is nearly terminal, broad and triangular in shape. In cross-section, the thick sides of the lorica are curved upward at an angle of about 100 degrees.

Testudinella armiger was collected among *Myriophyllum humile* and detached, floating *Eleocharis acicularis* in Pocono Lake during the summer of 1941. It was also collected among immersed *Sphagnum cuspidatum* in Lake Tamaque, 1940, and among *Utricularia vulgaris* along the shore of Promised Land Lake in 1939.

This species bears a superficial resemblance to *T. amphora* Hauer. It differs, however, by the shape of the body, the structure of the lateral antennae, the position and shape of the foot opening and in the cross-section of the lorica.

NOTES ON GEOGRAPHICAL DISTRIBUTION

Harring and Myers (1928) stated that the difference between hard and soft water rotifers could always be found; a glance at a collection told its origin at once. While this holds good today in a majority of cases, yet, in view of later investigations, the statement is not always born out by the facts.

Occasionally a body of soft water supports a rotatorian fauna composed of typical hard and soft water species about equally divided such as Pocono Pond (location no. 10) and Promised Land Lake (location no. 13).

If the pH of such a body of water is taken before and after boiling it will be found to raise considerably after boiling.

The pH of water of several locations was 6.1–6.2 before boiling and 7.2–7.4 after. This demonstrated that the low pH was caused by an excess of volatile gas, such as carbon dioxide. When heated, this gas boiled out, reducing the concentration of hydrogen-ions, and so raising the pH; the hardness of the water being masked by an excess of carbon dioxide. The total salts of such locations will be relatively high.

If the pH of a location such as Pocono Lake is taken before and after boiling it will be found to raise very little; in this case, from 6.4 to 6.6. This shows that the acidity of the water is caused by dissolved inorganic acids such as humic and tannic, and the rotatorian fauna will be composed of acid and transcurion species exclusively. The total salts will be relatively low.

Wiszniewski (1934) commented on the similarity of the psammolittoral fauna and that of wet *Sphagnum*, giving a table of these relationships.

It has been demonstrated that the great majority of psammolittoral species are found in the hygropsammon, while relatively very few exist in the hydropsammon.

Sphagnum bears a close ecological relationship to the psammolittoral, and we can divide a single frond into zones that correspond to those of the psammolittoral. The emersed portion, that which is continually moistened by capillary attraction, resembling the hygropsammon.

As in the hydropsammon, the immersed portion of fresh green *Sphagnum* is relatively poor in rotifers, while the emersed portion is rich. This also holds good for other Bryophytes growing along the margins of lakes and streams.

Fifty-two species of ploimate rotifers were collected in *Sphagnum subsecundum*, during the summer of 1941, forty-six of which were also found in the psammolittoral of Pocono Lake. Thirty-five species were common to both.

While there was a complete absence of psammobiotic rotifers in the *Sphagnum*, the presence of so many psammophile species served to illustrate in a striking manner the relationship between the two associations.

Pennak (1940) found that an average sand sample from the hygro-psammon contained about 400,000 rotifers per liter. Since there are only about 200 to 300 cc. of water in a liter of such sand, a liter of water would contain from 1,000,000 to 2,000,000 rotifers.

This seems to support the hypothesis advanced by Edmondson (in litt.) that the more surface of something exposed in a circumscribed location to a given volume of water, the more life it will support. Therefore, the abundance of life is proportional to the area of available surface.

This is also born out by the fact that there are roughly 500 limnetic rotifers to a liter of water; about 2,600 littoral ploimate rotifers to a liter, in which association the available exposed surface is much greater than in the limnetic region.

Sphagnum subsecundum was selected because of its large retort cells which add greatly to the exposed surface available.

Even though some of the exposed surface is on the inside of the retort cells, circulation is maintained with the surrounding water by means of the large terminal pores.

That the rotifer population is controlled by the available exposed surface of submerged aquatics is well demonstrated by the following list of the principal aquatics in order of their productivity:

1. *Drepanocladus exannulatus*.
2. *Fontinalis Novae-Angliae* and *F. disticha*.
3. *Eleocharis acicularis*, wind-blown floating masses.
4. *Sphagnum subsecundum* and *S. cuspidatum* (decaying).
5. *Utricularia vulgaris*, *U. gibba*.
6. *Myriophyllum humile*.
7. *Elodea canadensis*, *E. occidentalis*.
8. *Nitella flexilis*.
9. *Najas flexilis*.
10. *Potamogeton epihydrus*.

From the above list we see that the more dissected the leaves, the greater population the plant will harbor. In the case of submerged bryophytes, *Elodea*, and *Najas*, the slender leaves grow so closely together and the mats are so dense that the same result is reached.

SUMMARY

Twenty-four locations, including lakes and ponds of Northeastern Pennsylvania, most of them situated in the region known as the Pocono Plateau,

are reviewed. Altitude, length, principal aquatics, and average pH are listed.

Methods used in collecting, narcotizing, killing and preserving Rotatoria are given.

An annotated list of 457 Ploima and 32 Bdelliodea are presented.

Acid and alkaline water conditions as correlated to rotifer distribution, as well as a comparison between different associations and rotifer productivity are discussed.

Fourteen new species of Rotatoria are described.

LITERATURE CITED

- AHLSTROM, E. H. 1938. Plankton Rotatoria from North Carolina. Journ. Elisha Mitchell Sci. Soc., 54: 88-110.
- BILFINGER, L. 1894. Zur Rotatorienfauna Württembergs, Zweiter Beitrag. Jahresh. Ver. Vaterl. Naturk. 50: 49.
- BRYCE, D. 1892. On some moss-dwelling Cathypnadae; with descriptions of five new species. Science Gossip, London. 28: 271-275.
- EDMONDSON, W. T. 1936. New Rotatoria from New England and New Brunswick. Trans. Amer. Micr. Soc., 55: 220-222, pl. 38, figs. 3, 4.
- EHRENBURG, C. G. 1838. Die Infusionsthierchen als vollkommene Organismen. Leipzig. pp. XVIII + 547.
- HARRING, H. K. 1913. Synopsis of the Rotaria. U. S. Nat. Mus., Bull. 81, pp. 226.
- 1916. A Revision of the Rotatorian Genera Lepadella and Lophocharis with Descriptions of Five New Species. Proc. U. S. Nat. Mus., 51: 527-568.
- HARRING, H. K. and F. J. MYERS. 1922. The Rotifer Fauna of Wisconsin. I. Trans. Wisconsin Acad. Sci. Arts, Letters, 20: 553-656.
- 1924. The Rotifer Fauna of Wisconsin. II. Trans. Wisconsin Acad. Sci. Arts, Letters, 21: 415-540.
- 1926. The Rotifer Fauna of Wisconsin. III. Trans. Wisconsin Acad. Sci. Arts, Letters, 22: 315-423.
- 1928. The Rotifer Fauna of Wisconsin. IV. Trans. Wisconsin Acad. Sci. Arts, Letters, 23: 667-808.
- HAUER, J. 1935. Rotatorien aus dem Schluchseemoor seiner Umgebung. Verh. Naturwis., Karlsruhe, 31: 47-130.
- 1938. Die Rotatorien von Sumatra, Java und Bali. Archiv. f. Hydrobiol., Suppl., 15: 296-602.
- HUDSON, C. T. and P. H. GOSSE. 1886. The Rotifers or Wheel-Animacules, both British and foreign. 2: 144.
- MYERS, F. J. 1930. The Rotifer Fauna of Wisconsin. V. Trans. Wisconsin Acad. Sci. Arts, Letters, 25: 353-413.
- 1933. The Distribution of Rotifers on Mount Desert Island. III. Amer. Mus. Novitates, no. 666, pp. 18.
- 1934. The Distribution of Rotifers on Mount Desert Island. VI. Amer. Mus. Novitates, no. 760, pp. 10.
- STENROOS, K. E. 1898. Das Thierleben in Nurmijärvi-See. Acta. Soc. Fauna Fennica, 17: 259.
- TESSIN, G. 1890. Rotatorien der Umgegend von Rostock. Archiv. Freunde der Natur. in Mecklenburg, Güstrow, 43: 133-174.

- WIERZEJSKI, A. 1893. Rotatoria Galicyi. Bull. Int. Acad. Sci., Cracovie, pp. 402-407. 8: 154-171.
- WISZNIEWSKI, A. 1893. Recherches Ecologiques sur le Pdammon. Archiv. f. Hydrobiol.,
- WULFERT, K. 1937. Zur Kenntnis der Lebensgemeinschaften der Restlochgewässer des Braunkohlenbergbaus. Zeitsch. f. Naturw., 91: 56-69.

EXPLANATION OF PLATES 23 TO 25.

In order to avoid duplication, dotted lines in figures of loricated species indicate elements below the dorsal plate.

All figures are highly magnified. For actual measurements see text. Drawings not shown to scale, as it would be impossible to arrange the figures within the limits of an octavo page, while keeping the smallest sufficiently large to show the necessary detail.

PLATE 23.

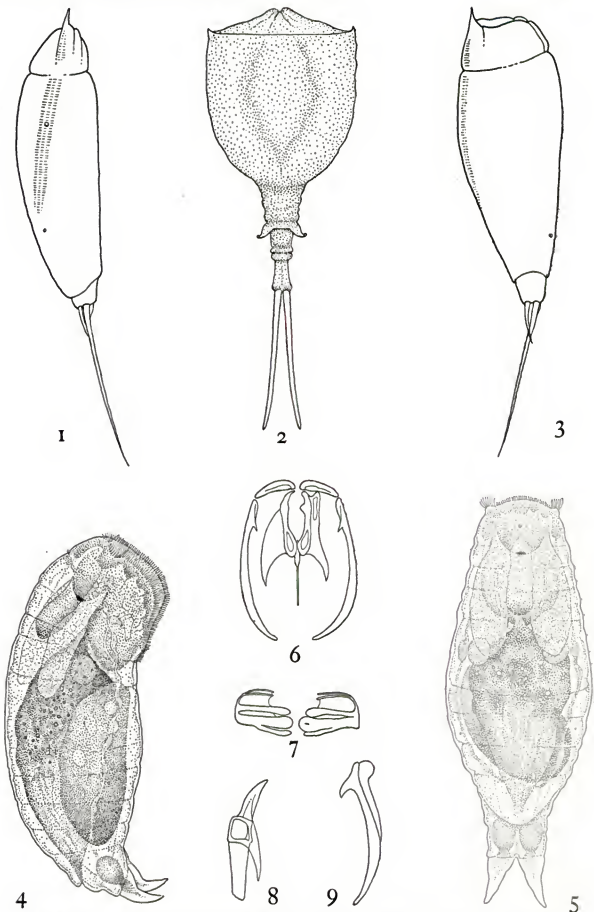
- FIG. 1.—*Cephalodella subsecunda*, lateral view.
- FIG. 2.—*Cephalodella sabulosa*, lateral view.
- FIG. 3.—*Cephalodella montana*, lateral view.
- FIG. 4.—*Aspelta chorista*, lateral view.
- FIG. 5.—*Cephalodella asarcia*, lateral view.
- FIG. 6.—*Aspelta chorista*, trophi, ventral view.
- FIG. 7.—*Trichocerca rossae*, head sheath, ventral view.
- FIG. 8.—*Cephalodella sabulosa*, cross-section of trunk.

PLATE 24.

- FIG. 1.—*Trichocerca harveyiana*, dorsal view.
- FIG. 2.—*Trichotria longipedis*, dorsal view.
- FIG. 3.—*Trichocerca harveyiana*, lateral view.
- FIG. 4.—*Notommata bennetchi*, lateral view.
- FIG. 5.—*Notommata bennetchi*, dorsal view.
- FIG. 6.—*Notommata bennetchi*, trophi, ventral view.
- FIG. 7.—*Notommata bennetchi*, unci, frontal view.
- FIG. 8.—*Notommata bennetchi*, incus, lateral view.
- FIG. 9.—*Notommata bennetchi*, manubrium, lateral view.

PLATE 25.

- FIG. 1.—*Lecane brevita*, dorsal view.
- FIG. 2.—*Lepadella minuta*, dorsal view.
- FIG. 3.—*Lepadella eurysterna*, dorsal view.
- FIG. 4.—*Testudinella armiger*, dorsal view.
- FIG. 5.—*Lecane leura*, dorsal view.
- FIG. 6.—*Lecane dysorata*, dorsal view.
- FIG. 7.—*Testudinella armiger*, cross-section.
- FIG. 8.—*Squatinella longispina*, foot and toe, lateral view.
- FIG. 9.—*Squatinella leydigii*, foot and toe, lateral view.
- FIG. 10.—*Trichocerca harveyiana*, trophi, ventral view.



MYERS: THE ROTATORIAN FAUNA OF THE POCONO PLATEAU
AND ENVIRONS

**NOTES ON SPECIES OF THE LOCUST GENUS *PARASPHERA*, WITH
DESCRIPTIONS OF THREE NEW SPECIES (ORTHOPTERA,
ACRIDIDAE, PYRGOMORPHINAE)**

BY JAMES A. G. REHN

Curator of Insects, The Academy of Natural Sciences of Philadelphia

Recently when called upon to determine a specimen of the pyrgomorphid genus *Parasphena*,¹ I found it necessary to assemble all available material of the genus, by far the greater part of which was undetermined. The study of this material has brought to light three previously undescribed forms, corrected the previous generic association of another, and made evident that in certain species of the genus there is a considerable amount of individual variation in features formerly considered of fixed character. Information on the latter situation will prove of definite service to those who in future may work with *Parasphena*.

Of the previously described species of the genus all are from Africa except two recently added from southwestern Arabia (Yemen). The species previously referred to *Parasphena* number eighteen,² one of which has re-

¹ *Parasphena* I. Bolívar, *Anales Soc. Españ. Hist. Nat.*, XIII, pp. 23, 436, 496, (1884). Included *P. pulchripes* (Gerstaecker) and *picta* I. Bolívar, of which the former was selected as genotype by Kirby in 1910 (*Synon. Catal. Orth.*, III, p. 321).

² *P. pulchripes* (Gerstaecker), *Archiv für Naturgesch.*, XXXV, p. 217, (1869), [*Sphenarium*]. [Mt. Kilimanjaro, E. Africa, elev. 8000 ft.] *P. picta* I. Bolívar, *Anales Soc. Españ. Hist. Nat.*, XIII, pp. 436, pl. 2, figs. 10-10a, (1884). [Massaua [Eritrea].] *P. nigropicta* I. Bolívar, *Journ. Sci. Nat. Lisboa*, (2) I, p. 150, (1889). [Caconda, Angola.] *P. dubia* I. Bolívar, *Bol. Soc. Españ. Hist. Nat.*, IV, p. 440, (1904). [Manow, East Africa (Tanganyika).] *P. picticeps* I. Bolívar, *Idem*, pp. 440, 441, (1904). [Transvaal.] *P. carinata* I. Bolívar, *Genera Insectorum*, fasc. 90 (Pyrgomorphidae), p. 28 footnote 1, (1909). [Asmara, Eritrea.] *P. meruensis* Sjöstedt, *Wissensch. Ergebn. Schw. Zool. Exped. Kilimandj.*, 17: 7, p. 179, pl. 7, figs. 7 and 8, (1909). [Mt. Meru and Mt. Kilimanjaro.] *P. keniensis* Sjöstedt, *Archiv für Zoologi*, VII, no. 38, p. 18, pl. 3, fig. 1, (1912). [Mt. Kenya, 2500 meters, Kenya.] *P. ruandensis* Rehn, *Wissensch. Ergebn. Deutschen Zent.-Afr. Exped. 1907-08*, V, *Zool. III*, lief. 1, p. 99, (1914). [Ninagongo, Virunga Volcanoes, n. of Lake Kivu, 3000 meters (type locality); various other localities in the Virunga Volcanoes and the Rugege and Bugoie Forests, Ruanda, 1800-2500 meters.] *P. albini* Chopard, in Babault's *Voy. Afr. Orient. Angl.*, *Res. Scient.*, *Orth.*, p. 54, fig. 3, (1921). [Southern Guaso Nyiro, Sotik, Kenya.] (See footnote 3.) *P. elgonensis* Sjöstedt, *Entom. Tidskr.*, 1933, p. 216, (1933). [Mt. Elgon, Kenya-Uganda.] *P. nairobensis* Sjöstedt, *Idem* p. 216, (1933). [Nairobi, Kenya.] *P. montana* Uvarov, *Journ. Linn. Soc. London, Zool.*, XXXVIII, p. 609, text-fig. 9m, (1934). [Mt. Chillalo, 10,000 feet, Abyssinia.] *P. abyssinica* Uvarov, *Idem* p. 611, text-fig. 9A, (1934). [Hawash River, west of Mt. Zuquala, 6000 feet, Abyssinia.] *P. yemenita* Uvarov, *Journ. Linn. Soc. London, Zool.*, XXXIX, p. 546, (1937). [Sanaa, Yemen, Arabia.] *P. tawfikii* Uvarov, *Bull. Soc. Entom. Egypte*, XXI, p. 275, figs. 1A-1C, (1938). [Gebel El-Nabi, Shobeib, Yemen, Arabia.] *P. cheranganica* Uvarov, *Mém. Mus. Nat. Hist. Nat.*, Paris, (n. s.) VIII, p. 167, fig. 7C, (1938). [Mt. Cherangani, Kenya, 3000-3500 meters (type

(Cont. at bottom of p. 288.)

cently been removed to the genus *Pyrgomorphella*,³ and to these I am now adding three new forms and bringing into the genus one previously referred to *Cavendia*, making a total at this time of twenty-one.

The species of *Parasphena* are readily divisible into two series by the presence or absence of evident but abbreviate slip-like tegmina. Apparently this division is less fundamental than might appear, but until a comprehensive revision is possible this feature will aid in the recognition of the various species. As the present comments are very largely based on apterous forms, I am merely separating the forms treated by this obvious criterion.

The distribution of *Parasphena* is particularly interesting, especially when certain information here presented is considered. In East Africa it is generally found frequenting mountain or plateau grassland areas, usually at considerable elevations, sometimes as high as 14,000 feet (*P. meruensis* Sjöstedt). The ranges of at least certain of the species appear to be completely and widely separated from those of other members of the genus, and probably the future will bring to light a number of additional isolated montane or submontane forms as our knowledge of African Orthoptera becomes more comprehensive. No lowland humid tropical types of the genus are known.

Apparently *Parasphena* was more continuously distributed during Pleistocene times. The comparatively close affinity of the components of certain of the East African aggregations points quite definitely to a relatively recent segregation of populations of older species, which may have taken place as recently as the Post-Pleistocene, and then possibly as reactions to increasing aridity and the correlated restriction of relatively cool savanna or grassland conditions, as distinct from the relatively dry savanna land now so largely a feature of African plant geography. The south Arabian forms give added evidence that much of that biota, relatively attenuate even though it is to-day when compared with the recent past, has a history similar to that of the plants and animals of northeastern Africa. The close affinity of *P. ruandensis*, of Ruanda, and *uvarovi*, of the Cameroons highlands, also clearly indicates a probably quite recent common ancestry, when these forms or their progenitor occupied lower levels in a cooler Central Africa.

In the systematic literature of the genus will be found a number of descriptions of new species which are insufficiently compared with their

locality); Marakwet, Kenya; Elgeyo Escarpment, Kenya, 2500 meters.] *P. kinangopa* Uvarov, Idem, p. 168, fig. 7K, (1938). [Mt. Kinangop, Aberdare Range, 2600 meters, Kenya (type locality), also 8000-13,000 feet on same peak; West Aberdare Range, 10,000-11,000 feet, Kenya.]

³ Uvarov, in a recently issued paper (Journ. East Africa and Uganda Nat. Hist. Soc., XVI, p. 27, (Sept. 1941), has referred Chopard's *albini* to the genus *Pyrgomorphella*, and considers it to be "very close to *Pyrgomorphella variegata* Key 1937, known from the Masai Reserve."

nearest relatives, or not compared at all. Little effort has been made in the past to analyze the extent of color dimorphism which is found in at least certain of the species. It is now evident that the exact form and proportions of the fastigium, as seen from the dorsum, varies in both sexes of at least several of the species of which moderate series are now before me. As the shape and proportions of the fastigium have been used as fundamental specific criteria, it is important that known variation in series from a single locality be recorded. This is done in the present study under *P. kinangopa*.

It is equally apparent that certain features of the female genitalia, which have not been used as diagnostic features, as the depth of the dorsal ovipositor valves and the exact shape of the lateral plates of the ventral ovipositor valves, have definite specific value, and to these may be added the relative width of the valves themselves.

The forms at this time referred to the genus which already have been described from Kenya Colony, from which area our knowledge of the genus is most comprehensive, are the following: *nairobiensis* Sjöstedt, from Nairobi;⁴ *keniensis* Sjöstedt, from Mt. Kenya at 2500 meters; *elgonensis* Sjöstedt, from Mt. Elgon at from 1700-3800 meters; *kinangopa* Uvarov, from various points in the Aberdare Range from 8000-11,000 feet; and *cheranganica* Uvarov, from the Cherangani Mountains and the Elgeyo Escarpment, east of Mt. Elgon, at elevations of 2500-3000 meters. In addition *P. pulchripes* (Gerstaecker) was described from Mt. Kilimanjaro on the Kenya-Tanganyika boundary, and has been reported from Naivasha by I. Bolívar, although knowing from personal acquaintance that environment I cannot help but question either the identification of the latter material or the correctness of the locality. Similarly *P. meruensis* Sjöstedt was described from Mt. Meru, just south of the Kenya-Tanganyika boundary, and is also known to occur on Mt. Kilimanjaro. All of these forms are apterous.

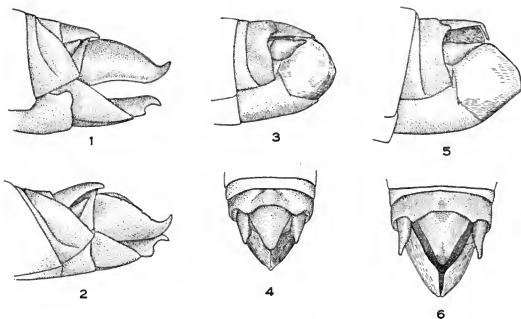
I wish to express the thanks of The Academy of Natural Sciences of Philadelphia to Prof. Neal Weber, of the University of North Dakota, for permission to retain the type of *P. imatongensis* here described.

Completely apterous species

I now have before me, in the Hebard Collection, a topotypic female of *P. pulchripes* (Gerstaecker) from 10,000-14,000 feet on Mt. Kilimanjaro, determined by and received from Dr. Uvarov; also a paratype female of *P. meruensis* Sjöstedt from Kibonoto, Mt. Kilimanjaro, at 1300-1900 meters,

⁴ Uvarov recently (Journ. East Africa and Uganda Nat. Hist. Soc., XV, p. 173, (May, 1941)) has reported *nairobiensis* from the Chyulu Hills, which are northeast of Kilimanjaro and southwest of Kibwezi, Kenya.

as well as two males and one female of the same species from Arusha, Tanganyika Territory, in the same collection.



Lateral and dorsal views of apices of abdomens, all greatly enlarged. FIG. 1.—*Parasphena kinangopa* Uvarov. Female. Kijabe section, Kikuyu Escarpment, Kenya. FIG. 2.—*P. campestris* new species. Female (type). Between Nanyuki and upper Guaso Nyiro, Kenya. FIGS. 3 and 4.—*P. ruandensis* Rehn. Male. Bugoie Forest, Ruanda. FIGS. 5 and 6.—*P. uvarovi* new species. Male (allotype). N'tem Plain, Cameroons.

***Parasphena kinangopa* Uvarov**

Text-fig. 1; pl. 26, figs. 1-8.

1938. *Parasphena kinangopa* Uvarov, Mém. Mus. Nat. Hist. Nat. Paris, (n. s.) VIII,⁵ p. 168, fig. 7K. 1 ♂, ♀; Forest house at 2600 meters on Mt. Kinangop, Aberdare Range, Kenya Colony (type locality)⁶; Mt. Kinangop, Aberdare Range, 8-13,000 feet, Kenya Colony; West Aberdare Range, 10-11,000 feet, Kenya Colony.]

KENYA COLONY: Gilgil to Laikipia; (G. M. Allen and G. Brooks; 1 ♀; [M. C. Z.]. Kijabe section, Kikuyu Escarpment, elevation 8200 feet; June 22-24, 1934; (George Vanderbilt African Expedition 1934; J. A. G. Rehn); 16 ♂, 7 ♀, 5 juv. ♂, 4 juv. ♀; [A.N.S.P.]. Limuru, Kikuyu Escarpment; March 15, 1922; (Dummer); 5 ♂, 7 ♀; [Hebard Cln. and A.N.S.P.].

The series from the Kijabe section of the Kikuyu Escarpment was taken in grassy glades or swales between patches of mountain forest, and from a coarse tussock grass and other low ground cover, made up in part of sedges, a tall nettles and a rather low thistle. This area is fog-drenched much of the time in June, and little insect life was evident except when the sun shone. Then *kinangopa* was exceedingly active, particularly the males, present in

⁵ Separata of this paper give no indication of the general series from which they have been derived, but with the original pagination are cited as part of "Tome IV, Zoologie" of the "Mission Scientifique de l'Omo."

⁶ Mt. Kinangop, the summit of which reaches an elevation of 12,772 feet, is located east of the settlement of Gilgil in the Eastern Rift Valley and is north of the peak of Mt. Satima.

fair numbers and rather broad in its plant preferences within the general environment frequented.

When compared with *P. keniensis* the present form is seen to be very closely related, but averages larger and appreciably more robust, particularly in the breadth across the thoracic segments, while the dorsal pronotal sculpture is more thickly and generally impressed, and less restricted to a smaller number of strumae, as in *keniensis*. In other respects the two forms are not readily distinguishable, when known intra-specific variation is considered.

As Uvarov in the original description measures but the male holotype, although both sexes were before him, I am giving the extremes of size range (in millimeters) in both sexes and both series.

	Length of body	Length of pronotum	Length of caudal femur
♂, Kijabe	14.6	2.77	7.8
♂, Kijabe	17.2	3.26	8.9
♂, Limuru	15.4	2.77	8.4
♂, Limuru	19.2	3.26	9.4
♀, Kijabe	21.6	3.91	9.4
♀, Kijabe	25.2	4.07	9.6
♀, Limuru	20.5	3.74	9.7
♀, Limuru	25.6	4.56	10.2

While the type measured by Uvarov is slightly smaller than the minima of the males of either series here examined, it may be that Mt. Kinangop material will average somewhat smaller than series from the plateau-like Kijabe area,⁷ which is but a moderate distance to the southward of the type locality.

It is very evident from the present series of this species, and doubtless will be found true of other forms of the genus, that there is a great amount of individual variation in the proportions and outline of the fastigium as seen from the dorsum. Uvarov's figure of the fastigium of the male type has this outline straight trigonal, more so than in any of that sex now before me. It is evident the figure is conventionalized with its lateral borders straight convergent, and thus over-emphasized, as Uvarov explicitly says in the description of the fastigium, "sides distinctly convex divergent," which is what I find in the specimens before me. The Kijabe series of males shows a broad range in the relative proportions of the fastigium, as seen from above, of length from eye margin to apex as compared with the greatest (proximal) fastigial width. Five representative males selected from the

⁷ This district, which is definitely within the mountain forest belt and fully montane in its characteristics, must not be confused with the vicinity of the station of Kijabe on the railroad, which is half way down from the top of the Kikuyu Escarpment to the floor of the Eastern Rift Valley, and at an elevation of 6787 feet, near the old volcano of Mt. Longonot.

sixteen from Kijabe, show stages in these ratios as follows: 19 (length) to 21 (breadth); 18 to 22; 16 to 22, 17 to 22; 18 to 25. The female sex shows much less plasticity in this feature, and the extremes of this sex from Kijabe give ratios of 20 (length) to 30 (breadth) and 22 to 30. The accompanying illustrations of the fastigia of these specimens (Pl. 26, figs. 1-7) show the variation in this feature in a series taken at the same place at the same time, and under similar conditions. In addition to the proportional differences the figures demonstrate the amount of variation in the exact curvature of the lateral margins.

A structural feature which has occasionally been used as of diagnostic value in this genus is whether the ultimate sternite (subgenital plate) of the male bears a medio-vertical indentation or sulcus on its caudal face. This is found present or absent, and in all degrees of emphasis when present, in the Kijabe series, and is indicated or absent in the adult and immature males. It appears to be due, when present, to muscle pulls in drying, but this may not be the true explanation. Certainly its presence has no systematic importance as some past literature might lead one to assume.

The Kijabe and Limuru series show that we have in *kinangopa* a broad and connected range of base color variation, together with that of certain supplementary pattern features. Both series, and both sexes, show in general tone a green extreme varying from javel green (Ridgway) to oil green in the males, and oil yellow to lettuce green in the females, while the opposite pole, the olive or fuscous phase, varies from clove brown and dark olive in the males, to as saturate a tone as blackish brown in the females. Between there is a fairly regular connecting series, particularly in the male sex. One dark female from Kijabe is unique in having the base tone strongly tinged with pansy purple, the caudal femora and portions of the pleura contrastingly green. In all the other females these limbs do not conspicuously differ from the general body tone. Certain females, in both extremes, show indications of a dorsal medio-longitudinal abdominal line, complete or broken, of buffy, others, in both phases, have a pair of dorso-lateral series of longitudinally disposed ochraceous spots, these in the green phase sometimes bordered ventrad by semi-circular blackish brown areas of varying intensity, one to a tergite.

The medio-longitudinal abdominal barring of ochraceous is pronounced in most of the males, as in fact it is in most of the related species. The apex of the abdomen is rather contrastingly pinkish to pinkish red in the Kijabe males, more ochraceous in those from Limuru. The red bordering of the sides of the fastigium and of the caudal margin of the pronotal disk is evident in virtually all of the Kijabe males, even the darkest of the brownish phase, but less evident in the females from that locality, a few of the darker of these showing no indications of red. The Limuru series shows

much less red than the Kijabe representation, the majority, of both sexes, having no red in the above mentioned areas. The cephalic margin of the pronotal disk is usually unmarked with red, this indicated solely in an occasional male. The caudal tibiae are pink or red throughout, varying in depth with the general tone, while the caudal femora, except as already noted, agree in color with the general body tone.

Of the Kijabe males the majority are in or more closely approach the green phase, while but two adult and one immature Kijabe females are of the same coloration. But one Limuru male is pronouncedly green, but two are approaching it, while five Limuru females are green against two brown.

The single female labelled "Gilgil to Laikipia" is fully typical of *kinangopa* in all respects except that the dorsal ovipositor valves are proportionately somewhat deeper, and the lateral plates of the ventral valves are stouter, less attenuate and more bluntly acute, the latter similar to what we find in *campestris* here described. Whether we have here evidence of intergradation between the two entities, and that *campestris* is therefore a geographic race of *kinangopa*, or instead an indication of hybridization of two distinct species along a contact line, remains for the future to determine. Certainly this specimen in general proportions, sculpture, proportions of cephalic and median femora and of eye outline is fully representative of *kinangopa*. Until we know more of the exact distributional limits of the two forms, and their definite intergradation, if this exists, we are unable to evaluate more precisely the evidence of this individual.

Whether *kinangopa* is limited to the immediate vicinity of the Aberdare Range and the Kikuyu Escarpment, which latter is continuous with the Aberdares to the southward on the eastern rim of the Rift Valley, or is found more broadly, remains to be determined. I have already given the conditions under which it occurs at Kijabe, and those at Limuru (elevation 7340 feet) are open rolling montane grassland with scattered patches of mountain forest still remaining in the general neighborhood.

Parasphena campestris ⁸ new species Text-fig. 2; pl. 26, fig. 19; pl. 27, fig. 13.

This form is more nearly related to *P. kinangopa* than it is to any other known to me. While close relationship to *keniensis* also exists, it is rather less intimate than with *kinangopa*. When compared with the latter, *campestris* is seen to differ in both sexes in having the eye outline proportionately longer and narrower as viewed in profile, in the more sharply-cut, definitely tuberculate and less strumose character of the postocular rugae on the sides of the head, in the denser, finer and more sharply impressed cribrose sculpture of the head and pronotum, in the slightly more robust cephalic and median femora, and in the female sex by the thicker ovipositor

⁸ I. e. *belonging to a plain*, in allusion to the general upland plain character of the habitat of the species at the type locality.

valves, particularly the dorsal ones, which also are distinctly deeper in elevation, and finally in the shorter, deeper and less strongly acute lateral plates of the ventral ovipositor valves.

As has been suggested under *P. kinangopa*, the future may show *campestris* to intergrade with the former, and therefore the two to be subspecies of a single species, but I prefer to await further information on this point before so treating *campestris*, which inhabits a different type of country from that in which *kinangopa* occurs. As has already been intimated, the limited information now available may indicate with equal propriety the hybridization of two entirely distinct species along a line of areal contact.

Type.—♀; between Nanyuki and the upper Guaso Nyiro, Kenya Colony. Elevation, 6000 feet. July 7, 1934. (George Vanderbilt African Expedition 1934; J. A. G. Rehn.) [Academy of Natural Sciences of Philadelphia, Type no. 5642.]

Size medium; body fusiform; surface of dorsum of head, pronotum and pleura cribrately rugoso-punctate, of remainder of body relatively smoother.

Head with normally exposed dorsal length equal to three-fourths that of the pronotum, definitely conoid cephalad as seen from dorsum, as well as in profile; fastigium from dorsum with greatest width at base (i. e. at cephalic border of eyes) 4.2 as compared with 3 in median length of fastigium cephalad of the same point, the margins arcuate convergent, width of interspace between eyes equal to three-fourths the basal width of fastigium; dorsal surface of fastigium and occiput with numerous, relatively low cicatroid anastomosing rugulae, in which a medio-longitudinal one is clearly evident; facial line strongly retreating, in profile moderately concave; frontal costa narrow, median impression fissately incised dorsad, less deeply cut ventrad; genae with the oblique postocular series of rugae marked, the individual elements linear or elliptical, definitely tuberculate and not collectively strumose; eyes but moderately prominent as seen from dorsum, in profile basal outline is relatively elongate, the greatest length to greatest breadth as 4.5 to 2.8. Antennae in length subequal to that of the dorsum of the head and pronotum combined.

Pronotum with medio-dorsal length equal to four-fifths that across the ventro-caudal angles of the lateral lobes, general form as in related species; cephalic margin of disk evenly low arcuate, caudal margin of same bisarcuate with the median emargination pronounced and obtuse-angulate but broad and shallow; median carina but weakly indicated, cephalad and on the metazona more apparent than between, always very low, definitely cut by three transverse sulci, the principal one at three-elevenths of the dorsal length from the caudal margin; surface of dorsum with its sculpture cribraro-areolate, relatively dense for the genus, the impressions sharp, the whole more finely cut and less strumose than in related species, the usual position of lateral carinae each with a single low, poorly defined, caudad diverging substrumose ruga; lateral lobes with their greatest dorsal length equal to one and one-third times the whole pronotal depth in the same view; ventro-cephalic angle rounded obtuse, ventral margin nearly straight oblique, ventro-caudal angles of the lateral lobes, general form as in related species;

angulately concave, surface of lateral lobes strongly rugulose, of the metazona with sculpture as cribose and as fine as on dorsum, of remainder of lobes coarser and more definitely strumose, particularly paralleling the ventral margin, which area in position continues the general postocular sculpture, although in a more strumose fashion. Mesonotum and metanotum with their caudal margins concave, of the latter more strongly so, surface shallowly and not conspicuously sparse impressed-cribose. Apterous. Pleura largely cribroso-rugose, supra-coxal tooth marked. Interspace between mesosternal lobes transverse, its cephalic width twice its length, internal margins of lobes slightly straight convergent to the rounded rectangulate meso-caudal angle, caudal margin of lobes slightly sigmoid. Interspace between metasternal foramina narrow, strongly transverse, width equal to approximately four and one-half times the length.

Supra-anal plate acute trigonal, slightly longer than proximal width, apex very narrowly rounded, strongly tectate in transverse section but lacking any medio-dorsal carinae or similar sculpture. Cerci acute trigonal, styliform, appreciably compressed, failing to reach apices of infra-cerebral plates. Subgenital plate with distal margin broadly but shallowly concave mesad. Dorsal ovipositor valves stout, relatively thick as seen from dorsum, in profile with the dorsal outline sigmoidally descending to the recurved apical hook, dorsal surface ruguloso-tuberculate within lateral margins; ventral ovipositor valves with lateral plates with proximal depth but slightly less than ventral length (as 2.5 to 3), the dorsal margin straight declivent caudad to the moderately acute apex, ventral margin very slightly convex.

Cephalic and median femora but moderately inflated, the length of the cephalic equal to two-thirds that of the pronotal dorsum, the median more elongate. Caudal femora with length equal to four and one-half times the greatest femoral depth, evenly tapering distad for most of its length, paginal pattern deeply etched, the oblique rugae in definite relief; caudal tibiae with nine spines on each margin, the internal ones somewhat longer than the external.

Allotype. — δ ; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the description of the type in the following noteworthy features.

Size small, body more elongate fusiform, proportionately more slender.

Head with normally exposed dorsal length equal to that of pronotum, more slender conoid as seen from dorsum and in profile; fastigium with greatest width at base (i. e. at cephalic border of eyes) to median length of fastigium from same point as 2. to 1.8, the lateral margins more subparallel proximad than in female, similarly arcuate convergent distad, width of interspace between eyes equal to three-fourths the basal width of fastigium; dorsal surface of fastigium and occiput with rugulae similar to but finer than those in the female, the median carina and the internal fastigial arcuation more sharply defined and continuous: facial line more strongly retreating than in female, equally concave; frontal costa as in female: eyes larger and much more prominent than in female, in profile more truly

elliptical in basal outline, the greatest length to greatest breadth as 2.9 to 2. Antennae similar to but slightly more robust than in female.

Pronotum with medio-dorsal length almost equal to that across the ventro-caudal angles of the lateral lobes; cephalic margin of disk shallowly emarginate mesad, caudal margin with median emargination deeper and sharper than in female; median carina slightly more evident than in female but of a similar cicatriform character; lateral rugae in the usual position of the lateral carinae somewhat more clearly delimited than in the female; lateral lobes with their greatest dorsal length equal to one and three-fifths times the whole pronotal depth in the same view; ventro-caudal angle rounded rectangulate, less prominent than in the female sex, caudal margin of lobes less strongly concavo-emarginate than in the opposite sex. Interspace between mesosternal lobes subquadrate, the lobes subquadrate with their internal margin moderately convex, caudal margin of lobes transversely subtruncate. Interspace between metasternal foramina definitely transverse but less strongly so than in female.

Tergite preceding the supra-anal plate with its distal margin triundulate, having a broad concavity mesad and paired lateral juxta-cereal ones, while between these the margin is arcuately sublobate. Supra-anal plate trigonal, very slightly longer than proximal width, in section transversely arcuate, unsculptured. Cerci stout, simple, conically styloform, not reaching to apex of supra-anal plate, acute apex very slightly decurved, as seen from dorsum slightly incurved distad. Subgenital plate subcompressed, as seen in profile with its distal outline arcuate, the extreme distal point definitely caudad of that at which the acutely convergent dorsal margins join when viewed from the dorsum.⁹

Cephalic and median femora much more strongly inflated than in female, their proportionate length the same. Caudal femora with proportions and sculpture as in female.

Coloration.—The species is dichromatic, having light green and olive green phases, the most extreme condition of the latter being represented by the type. I have seen no males in this extreme olive phase. Light phase: General tone between courage green and oil yellow (Ridgway), the dorsum of the abdomen darkening to oil green, the dorsum of the head and the general color of the genae with an olive overwash, against which the postocular tubercles and of a much lesser degree those of the occiput and vertex are contrastingly very pale salmon to cream color; medio-dorsal line on the pronotum pencilled with zinc orange, caudal margin of disk edged with ferruginous, usual position of lateral lobes and cephalic margin of disk washed with hays russet (male) to mars brown (female), rugose ventral section of lateral lobes corresponding in tone to the postocular strumae of the head; relatively broad medio-dorsal line on the meso- and metanota and abdomen continuously marked with ochraceous-orange, paler in the female than in the male, narrowly bordered on each side with fuscous pencillings which are subobsolete in the male, the cephalic halves of the mesonotum and metanotum washed with fuscous in the female; broken dorso-lateral abdominal lines of mustard yellow to ochraceous-orange are marked (female and one male) or subobsolete (one male); pleura of the

⁹ Both the type and the paratypic male have the disto-median area of the subgenital plate narrowly linear impressed vertically. See discussion under *P. kinangopa*.

base color or sublongitudinally marked with ochraceous-orange (one male); limbs largely of the general color, the paginae of the caudal femora pencilled in chrysolite green, the median dorsal carina lined more or less definitely with purplish, caudal tibiae ranging from purplish lilac to corinthian red, the spine cream, black tipped; eyes tawny-olive to saccardo's umber; antennae fuscous except for one or two pale proximal articles. Dark phase: Pattern essentially as in light phase, general tone buffy olive to dark greenish olive, the dorsum of the abdomen but little darker than that of head and pronotum, medio-dorsal and paired lateral pale abdominal markings as in light phase, pronotum with the darker markings in the usual position of the lateral carinae less evident than in light phase, median pale pencilling and marginal coloring of pronotal disk as in light phase, remaining features as in latter.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of caudal femur
♂, <i>allotype</i>	16.8	2.9	8.3
♂, <i>paratype</i>	15.6	3.2	8.2
♀, <i>type</i>	20.7	4.2	9.9
♀, <i>paratype</i>	23.1	4.2	9.7
♀, <i>paratype</i>	19.8 ¹⁰	4.4	9.6

In addition to the type and allotype I have before me one male and two female paratypes, as well as one immature female in the instar preceding maturity and a very immature male, all taken with and bearing the same data as the type and allotype. This series was captured in a wet area in the broad nearly flat upland stretching eastward to the Guaso Nyiro from Nanyuki and Naromoru. Here it was very local and rather scarce, all seen being taken. The individuals were fair jumpers but not difficult to capture.

Parasphena keniensis Sjöstedt

1912. *Parasphena keniensis* Sjöstedt, Arkiv för Zoologi, VII, no. 38, p. 18, pl. 3, fig. 1. [♂, ♀; Mount Kenya, 2500 meters to forest border, British East Africa [Kenya Colony].]

KENYA COLONY: West side of Mt. Kenya, above Naromoru, elevation 7800 feet; July 10, 12 and 13, 1934; (George Vanderbilt African Expedition 1934; J. A. G. Rehn); 11 ♂, 8 ♀, 1 juv. ♂, 1 juv. ♀; [A.N.S.P.]. Plains west of Mt. Kenya¹¹; September 10 [1909]; (G. M. Allen and G. Brooks); 1 ♀; [M.C.Z.].

¹⁰ Abdomen somewhat shrivelled.

¹¹ My friend Dr. Glover M. Allen, one of the collectors of this specimen, writes me that on September 9, having broken camp at 10,000 feet, their party "started down the mountain, reaching camp at 4 P. M., on the plain where one of the many mountain streams crosses the narrow trail at right angles. On the 10th we left this camp and marched over the plains westerly for four hours in the morning. Probably this was the place whence the locust came." Apparently this was somewhere in the neighborhood of the present small settlement of Naromoru, which is about sixteen miles north of Nyeri.

All of the above series taken by me in July 1934 were secured in open grassland immediately below the lower edge of the mountain forest. They were in small local colonies, but occurred on virtually any of the components of the low ground cover. The males were relatively more numerous, and far more active, than the females. Both immature individuals represent the instar preceding maturity.

The outline of the fastigium, as seen from the dorsum, varies appreciably, but not as markedly as in the series of *kinangopa* already discussed. It is evident, however, the same factor for variation in relative proportions and marginal arcuation of the fastigium occurs, and probably in an equally extensive series would be as pronounced in *keniensis* as in *kinangopa*.

In size the tendency in both sexes is more toward the minima given by Sjöstedt than in the direction of the maxima, the latter for total body length not being fully attained by any of the present representation. The subgenital plate of the male shows the same variation in the presence or absence of a medio-vertical sulcation noted under *P. kinangopa*.

The coloration, which in no case has been altered by liquid preservation, as was the case with the typical series, is dichromatic as in *kinangopa*, with the green phase represented by all but one of the males and but two of the females, while the brown phase is exemplified by one male and the remaining females.

Our knowledge of the distribution of the species is drawn from the original material and that here recorded, which would indicate the general limitation of *keniensis* to Mt. Kenya and its relatively immediate neighborhood.

In passing I might say I have seen no material which might be referred to Sjöstedt's *P. nairobiensis*, the type locality of which is but twenty-five miles to the southeastward of Limuru, where *kinangopa* occurs, but some 1900 feet lower.

Parasphena imatongensis new species

Plate 26, fig. 10; pl. 27, fig. 14.

When compared with Sjöstedt's *P. elgonensis*, of Mt. Elgon, and *P. cheranganica* Uvarov, of the Cherangani Mountains and the neighboring Elgeyo Escarpment, which are its nearest relatives geographically speaking, the present species differs from the descriptions of both in its broader head and pronotum, and much heavier and definitely granulate sculpture of the pronotum as a whole, the pronotal disk also having the first (anterior) transverse sulcus as evident as are the second and third (principal). When compared with female material of *kinangopa*, *campestris* and *keniensis* here recorded, *imatongensis* differs from all three in its more robust build, with broader head and pronotum, in the deeper pronotum as viewed in profile, and the more sharply acute apices of the genicular lobes of the caudal femora. In profile the ovipositor valves and the shape of the lateral plates on the

ventral pair are essentially as in *kinangopa*. From *keniensis* the new form is also separated by the more closely reticulate sculpture of the dorsum of the pronotum, while the lateral outline of the ovipositor valves, as with *kinangopa*, is very similar. From *campestris* in addition to the collective features already given, *imatongensis* can be separated by its shorter eye outline (in this agreeing with *kinangopa* and *keniensis*), its more coarsely sculptured pronotum and by its more shallow ovipositor valves, which, however, are as thick in basal width as in *campestris*.

Type.—♀; Summit of Mount Kineti, Imatong Mountains, Anglo-Egyptian Sudan.¹² Elevation 10,458 feet. July 24 to August 5, 1939. (N. A. Weber; in grass and herbs.) [Academy of Natural Sciences of Philadelphia, Type no. 5644.]

Size slightly larger than the average for the sex in *P. kinangopa*; form similar to but somewhat more robust than that of relatives; general distribution of surface sculpture as in related forms.

Head broad, as seen in dorsal and cephalic aspects more decidedly broadening ventro-caudad; fastigium as seen from dorsum with width at cephalic eye angle to length distad of same point as 7 to 10, cephalic apex of its outline, as seen in the same aspect, more definitely blunted than in *keniensis* and *kinangopa*, in profile the fastigium is proportionately deeper when compared with length than in the same two species; facial line in profile somewhat less strongly oblique than in the East African species already discussed; frontal costa deeply sulcate, weakening near clypeal suture; sculpture of whole head more rugulose than in relatives; eyes broad ovoid in basal outline, greatest width, which is at ventro-caudal fourth, to greatest length as 6.5 to 9, the latter equal to half the genal length obliquely from the eye to the caudal base of the mandible; antennae but slightly longer than the dorsum of the pronotum.

Pronotum relatively broad but with general form as in related species, in profile with greatest depth from median line of pronotum to bottom of lateral lobes to greatest dorsal length of lobes as 21 to 26; all three transverse sulci of the disk are equally evident, the metazonal greatest dorsal length equal to slightly more than a fourth the pronotal length; sculpture of pronotal dorsum deeply impressed ruguloso-punctate, producing a more granulate appearance than in the related form; lateral lobes of the pronotum with their sculpture more generally rugulose than in related species.

Ovipositor valves seen in profile much as in *kinangopa*, the greatest depth of the dorsal valves equal to four-ninths their greatest length, lateral plates at base of ventral valves very acutely attenuate distad, their greatest evident length distad of the subgenital plate being twice their proximal depth; subgenital plate of the same shape as in *P. kinangopa* and *keniensis*.

¹² The Imatong Mountains are situated on or near the boundary between the Anglo-Egyptian Sudan and the Uganda Protectorate, due north of Kitgum in the latter, and about sixty miles northeast by east from Nimule on the Bahr-el-Jebel. Mt. Kineti, the highest point, is entirely in the Sudan, its summit about five miles from the boundary, but other smaller peaks are directly on that line. Approximate position of Mt. Kineti, 3° 56' N., 32° 55' E. For a brief analysis of Prof. Weber's work in the Imatong Mountains see the 1940 Year Book of the American Philosophical Society, pp. 271-272.

Caudal femora reaching to the base of the ovipositor valves, genicular lobes distad very sharply acute, distinctly more so than in any of the related species which I have examined; caudal tibiae with nine external (including distal) and ten internal spines.

Coloration.—The unique type has been dried from alcohol and in consequence its coloration has been so greatly altered as to be valueless in a descriptive sense. Virtually none of the original pattern has been retained.

Measurements.—Length of body, 23.8 mm.; length of pronotum, 4.4; length of caudal femur, 11.4.

The type of this species is unique.

***Parasphena ruandensis* Rehn** Text-figs. 3 and 4; pl. 26, fig. 11; pl. 27, fig. 15.

1914. *Parasphena ruandensis* Rehn, Wissensch. Ergebn. Deutschen Zent.-Afr.-Exped. 1907-1908, V, Zool. III, lief. 1, p. 99. [♂, ♀; Ninagongo, Virunga Volcanoes, north of Lake Kivu (type locality); Karissimbi, Virunga Volcanoes; Southeast shore of Lake Kivu; Rugege Forest, southwest Ruanda; Bugoie Forest, northwest Ruanda.]

RUANDA: Southwest Ruanda, elevation 2700 meters; September 5-6, 1911; (H. Meyer); 1 ♂, 9 ♀; [Berlin Zoological Museum and A. N. S. P.].

This series has been compared with paratype and other material studied when the species was described. The Meyer representation apparently was taken in the Russiga Mountains, to the southward of the Rugege Forest, whence came much of the original series.¹³ Three of the females are teneral, and all now reported are in the green phase.

This species can at once be separated from all the other apterous species I have seen except the here-described *P. uvarovi*, by the acutely produced fastigium, as seen from the dorsum, while the male supra-anal plate in outline is almost an equilateral triangle, much as Uvarov figures for that sex of *P. cheranganica*,¹⁴ while the broad concave emargination of the penultimate tergite in the same sex is also as in that species. It would seem that *cheranganica*, in these respects at least, is nearer *ruandensis* than is any other East African species. As *ruandensis* has never been figured, I am here giving illustrations of both sexes from the basis of material which formed part of the original series.

Parasphena uvarovi¹⁵ new species Text-figs. 5 and 6; pl. 26, fig. 12; pl. 27, fig. 16.

Closely related to *P. ruandensis* Rehn, agreeing in the general body form, the very acutely and characteristically formed fastigium and in the form of the male penultimate and ultimate tergites and the cerci. From

¹³ For an account of Hans Meyer's route see his "Auf neuen Wegen durch Ruanda und Urundi (Ost-Afrika)," in the Zeitschrift der Gesellschaft für Erdkunde zu Berlin for 1912, pages 107 to 135.

¹⁴ *P. cheranganica* Uvarov, Mém. Mus. Nat. Hist. Nat., Paris, (n. s.) VIII, p. 167, fig. 7c, (1938). [♂, ♀; Mt. Chirangani, Kenya, 3000-3500 meters (type locality); Marakwet, Kenya; Elgeyo Escarpment, Kenya, 2500 meters.] The Elgeyo Escarpment is 20 miles east from Eldoret in the Uasin Gishu Plateau.

¹⁵ In honor of my friend Dr. B. P. Uvarov, whose contributions have so greatly broadened our knowledge of the African Acrididae.

ruandensis, however, the present species can at once be separated by its much larger size in both sexes, by the caudal margins of the dorsum and lateral lobes of the pronotum being less strongly undulate and by the less attenuate and deeper female ovipositor valves, which also have their apices much more definitely falcate, while the lateral plate of the ventral valves is proportionately much shorter, stouter and less lanceolate.

It is evident from the close affinity of *uvarovi* with *ruandensis* that they have been derived from a common ancestor, and that their isolation in widely separated areas has been relatively recent. The occurrence of *uvarovi* in the Cameroons highlands, at an air-line distance of over fourteen hundred miles from the nearest area where its close relative *ruandensis* occurs, and with no known member of the genus inhabiting the intervening territory, adds another interesting item on the origin and history of the biota of these still poorly known West African mountains.

Type.—♀; Ntém Plain,¹⁶ British Cameroons. December 31, 1908. (Riggenbach.) [Berlin Zoological Museum.]

Size large (for the genus); body shape elongate fusiform; surface of head, thorax and more proximal abdominal tergites with more or less closely placed small pustuliform tubercles.

Head sharply conical cephalad, its greatest dorsal length but very slightly greater than its greatest caudal width as seen from the dorsum, occiput but slightly rounded; fastigium sharply conical, its lateral borders, as seen from the dorsum, evenly straight convergent from base to distal fourth, thence to apex more sharply convergent and there subrectangulate, greatest length cephalad of eyes very slightly greater than basal width at cephalic border of eyes (as 11 to 10), median fission of fastigium clearly evident as an incised line on cephalic half of fastigial dorsum, in profile the section of the fastigium with more sharply converging borders is appreciably declivent, interspace between eyes but slightly less than greatest (basal) width of fastigium; facial line in profile strongly retreating, appreciably concave briefly ventrad of antennal bases, ventral outline of fastigium in same aspect convex; frontal costa very narrow, shallowly and finely linear sulcate, this regularly narrowing dorsad and ending before the fastigio-facial angle; lateral facial carinae more evident than those of frontal costa, subparallel between the eyes, strongly outbowed ventrad of same; eyes relatively small yet moderately prominent as seen from dorsum, in lateral aspect short ovoid in basal outline, the width to length as 7 to 8, the eye length contained two and three-fourth times in the oblique

¹⁶ The locality on the label is "N'tem Ebene." The name "Ntém" is given on the Kamerun Fumbán sheet of the "Groszer Deutscher Kolonialatlas, no. 5," published in Berlin in 1911, for a district and a town which are now in the British Cameroons, almost on the dividing line between "Cameroons North" and "Cameroons South," both of which are administratively attached to Nigeria. The Ntém district is on the divide between the upper Donga River (Benue system) and the headwaters of one of the tributaries of the Mham (Sanaga system), and the approximate position of the town of Ntém is 11° 6' E., 6° 20' N. The town of Nsob, which appears on certain smaller scale atlases, is west by north of Ntém about 18 kilometers. The elevation of the town of Ntém is given as 1100 meters.

length of the genae from eye to ventro-caudal angle. Antennae in length subequal to one and one-half times the length of the pronotal disk, relatively thick, in no way flattened, articles fourteen in number (up to sixteen in one female paratype).

Pronotum with greatest width across ventro-caudal portion of lateral lobes slightly greater than median length of disk, evenly arcuate dorsad in transverse section; cephalic margin of disk arcuato-truncate with a very faint and shallow median emargination,¹⁷ caudal margin of disk broad but low arcuate with a very faint and broad median emargination; median carinula very low but distinct, lateral carinulae of disk indicated only by linearly grouped pustules and these largely on the prozona, where they are roughly subparallel to the median one; prozona (i. e. the area cephalad of the more caudal transverse sulcus) equal to three times the length of the metazona, the median transverse sulcus as deeply impressed as the principal (more caudal) one, both continuing ventrad upon the lateral lobes; lateral lobes distinctly longer than greatest depth of pronotum as seen in profile, cephalic margin straight oblique, ventro-cephalic angle very obtusely rounded, ventral margin oblique becoming straight in caudal fourth, ventro-caudal angle subrectangulate, caudal margin moderately concave, in addition to the continuations of the two dorsal sulci across the greater part of the surface of the lobes, there is a less distinct intermarginal cephalic one which does not cross the dorsum. Mesonotum with caudal margin but faintly concave, that of metanotum quite definitely so with its caudo-lateral angles well rounded. Prosternum with the production of its cephalic portion a raised transverse collar-like wall, the outline of which, as seen in caudal aspect, is transverse arcuate. Interspace between the mesosternal lobes markedly transverse, its width about twice the lateral length, the lobes with their internal and caudal margins forming a definite right-angle. Interspace between the metasternal foramina slightly greater than that between the mesosternal lobes.

Tenth abdominal tergite strongly semi-elliptical emarginate mesad,¹⁸ this extending to the exposed base of the tergite; supra-anal plate with its base filling the median emargination of the tenth tergite, the more distal portion acute trigonal, separated from the basal section by a strongly impressed transverse arcuate sulcation; cerci short, blunt and broad conical, compressed, their acute apices not reaching more than half-way to the apices of the infra-cercal plates; ovipositor valves moderately compressed, dorsal valves with their exposed proximal depth but slightly more than one-third their exposed length (as 3.5 to 9), lateral surface deplanate, dorsal surface tuberculato-rugose with the distal section concavely excavate meso-ventrad, apices well hooked as seen in profile; ventral ovipositor valves with apical hooks pronounced, separated by a strongly marked transverse arcuate channelling, proximad of which the stouter basal sections of the valves have pronounced transverse burr-like cutting margins, lateral plates of the ventral valves with exposed length about twice the exposed proximal depth, dorsal margin straight oblique, ventral margin moderately arcuate, particularly in distal half, apex acute; subgenital plate with the median projection

¹⁷ This is absent in certain females in the paratypic series.

¹⁸ In the paratypic females this is seen to become sharply acute-angulate without any trace of marginal arcuation.

of the distal margin acute lanceolate, its proximo-lateral angles fissately cut-back, lateral sections of the same margin subarcuate.

Cephalic and median limbs relatively slender. Caudal femora very slender and attenuate, quite definitely more so than in *ruandensis*, the greatest depth contained slightly more than six times in the femoral length, as against less than 5.5 in *ruandensis*, the dorsal and ventral outlines nearly straight convergent to the pregenicular point of least depth, pattern of external pagina almost entirely a series of oblique parallel lines, ventro-external face similar to but appreciably narrower than in *ruandensis*, genicular lobes sharply acute, distinctly more so than in *ruandensis*; caudal tibiae with 8 to 9 external spines (including the distal one) and 9 to 11 internal ones (the latter figure in certain of the female paratypes).

Allotype.— δ ; same data as type. [Berlin Zoological Museum.]

Differing from the description of the type female in the following noteworthy features.

Size much smaller than in the female, yet large for the male sex in the genus; body shape more slender and less definitely fusiform than in the female, surface sculpture less strongly evident.

Head more elongate conical, its greatest dorsal length equal to one and a quarter times its greatest caudal width as seen from the dorsum, occiput nearly straight in lateral aspect; fastigium evenly and sharply acute as seen from the dorsum, the lateral margins without a definite angulation, fastigial proportions and fission as in female, in profile the apex of the fastigium is more rounded and less sharply acute than in the female; lateral facial carinae much less strongly outbowed ventrad of the eyes than in the female; eyes in basal outline more elliptico-ovate than in the female, with the greatest depth, which is at the caudal fourth, subequal to the length, which latter is contained twice in the oblique length of the genae from eye to ventro-caudal angle. Antennae heavy, in length hardly less than twice as long as the pronotal disk, faintly flattened proximad, composed of fourteen articles.

Pronotum with lateral carinulae of disk as poorly marked as in the female but not as apparently formed by postules; proportions of prozona and metazona and the character and emphasis of the transverse sulci as in the female; lateral lobes as in female except that ventro-caudal angle is somewhat more produced and evident than in the female. Interspace between mesosternal lobes broad cuneate, slightly broader than long, internal margins of lobes somewhat more converging caudad than in female. Interspace between the metasternal foramina slightly less than that between the mesosternal lobes.

Tenth abdominal tergite with its distal margin having its whole section adjacent to the base of the subgenital plate emarginate, the median portion of this being transverse, the lateral ones converging straight oblique, at the lateral bases of the emargination are placed small but distinct rounded nodes; supra-anal plate in shape an equilateral triangle, the apex slightly prolonged and markedly decurved; cerci trigonal, short and stout, basal depth contained one and one-half times in length, apex very briefly attenuate, much less so than in *ruandensis*, slightly decurved, not reaching as far caudad as the apex of the supra-anal plate; subgenital plate appre-

ciably compressed, as seen in profile the distal half of the dorsal outline and the distal outline form a right angle to one another, with the immediate angle rather broadly rounded, the more proximal portion of the dorsal outline declivent ventro-cephalad at an obtuse angle from the more distal portion of the same outline, the intermediate angle broadly rounded, as seen from the dorsum the more proximal section of these margins obliquely diverge toward the cercal bases, while the distal sections are subparallel and subcontiguous, the intervening fissation continuous across the distal section or apex of the plate with the well-marked vertical fissure-like median sulcation of the distal face of the same.

Cephalic and median limbs, and particularly the femora, proportionately more robust and subinflated than in the female. Caudal femora as in female but very slightly more robust proportionately, the greatest depth being contained approximately five and one-half times in the greatest length, dorsal and ventral outlines not as straight as in the female; caudal tibiae with 7 to 8 external and 10 internal spines.

Coloration.—Whether the color tones of the preserved material of *uvavovi* are those of nature, or have been produced by methods of killing, preservation or desiccation I am unable to say. I feel that some change from the coloration of the living insect has taken place, but how much remains to be determined, and the following notes are from the material in its present condition. General tone ranging from orange-cinnamon (type) to honey yellow or even chamois, the limbs generally, and always the caudal, clearer yellowish, even as brilliant as amber yellow in one paratype; pustules on head and thorax, and even at times the paginal pattern and carinae of the caudal femora, as light as cream color or straw yellow, producing a definite contrast with the base color; ventral surface of the single male seen (allotype) and to a lesser, more attenuate and incomplete degree of the females washed with carmine, the genae and the cephalic and median tibiae in the male weakly washed with the same tint, which tendency is indicated only in the weakest degree in the females; eyes buckthorn brown to dresden brown; antennae fuscous; distal extremity of the caudal femora washed with olive and the genicular arches fuscous; caudal tibiae clay color to saccardo's umber, in females sometimes infusate distad, spines very briefly fuscous-tipped.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of caudal femur
♂, N'tem Plain, <i>allotype</i>	17.7	3.4	9.3
♀, N'tem Plain, <i>paratype</i>	23.9	4.2	10.4
♀, N'tem Plain, <i>type</i>	30.9	5	12.8
♀, N'tem Plain, <i>paratype</i>	34.2	5.7	14.6

While the majority of the females examined are nearer the maximum measurements given, one other female approaches the minimum. These two are adult and the size range in at least the female sex is thus seen to be considerable.

In addition to the type and allotype I have before me six females bearing the same data as the type and allotype, two of the same sex from Kumbo, now in the South Cameroons District of the British Cameroons,¹⁹ taken December 28, 1908 by Riggenbach, and a single female also taken by Riggenbach on December 4, 1908, labelled Japave or Tapave, a locality I am quite unable to place. All of these specimens I am considering paratypes. The type, allotype and four of the paratypes will be returned to the Berlin Zoological Museum, one paratype placed in the British Museum (Natural History) and four retained in the Academy series.

Forms with slip-like tegmina

I have been able to examine the following previously unrecorded material of species belonging to this division of the genus:

P. picta I. Bolívar. Eritrea; 1 ♀; [Hebard Cln.].

P. carinata I. Bolívar. Eritrea; 1 ♀; [Hebard Cln.].

P. dubia I. Bolívar. Manow, Tanganyika²⁰; 1 ♀ (topotype); [Hebard Cln.].

***Parasphena gallae* (Rehn)**

Plate 27, figs. 17 and 18.

1901. *Cawendia gallae* Rehn, Proc. Acad. Nat. Sci. Phila., 1901, p. 373. [♂; Sheikh Husein, Gallaland.]

The unique type of this species is now before me in the Academy series, and shows that *gallae* is a brevialate member of the genus *Parasphena* and not a *Cawendia*. It is related to, but distinct from, Uvarov's two Abyssinian species *montana*²¹ and *abyssinica*²², differing from the description of the former in its distinctly larger size, longer and narrower fastigium, the lateral margins of which are subparallel, the longer tegmina, which reach to the base of the third abdominal tergite, as well as in the more narrowly emarginate ultimate tergite of the male, and various details of the coloration. From *abyssinica*, on the basis of its description, I find *gallae* can be separated by the more pronounced sculpture of the occiput and postocular area of the head, by the first transverse sulcus of the pronotal disk being obsolete, by the definitely longer and shallower lateral lobes of the pronotum, and by the definitely longer tegmina. It would appear from

¹⁹ This locality was in the Bango or Bausso District of the old German Kamerun, a distance of approximately 45 kilometers WSW. of N'tém, its position roughly 10° 45' E., 7° 12' N., and its elevation 1665 meters.

²⁰ Manow, which is the type locality of quite a few species of Orthoptera, is in the extreme southwestern portion of Tanganyika Territory. Its position is 16 kilometers due east of New Langenburg, and thus about 35 kilometers northwest of the head of Lake Nyasa.

²¹ Journ. Linn. Soc. London, Zool., XXXVIII, p. 609, text-fig. 9M, (1934). [♂, ♀; Mt. Chillalo, Abyssinia, 10,000 feet.]

²² Idem, p. 611, text-fig. 9A. [♂, ♀; West of Mt. Zuquala, at the Hawash River, Abyssinia, 6000 feet.]

the descriptions of Uvarov's Abyssinian species that *gallae* occupies a position intermediate between them, but this can be determined definitely only by actual comparison of material.

As *gallae* has never been figured previously, I am presenting two views of the unique type.

EXPLANATION OF PLATES 26 AND 27

PLATE 26.

Parasphena kinangopa Uvarov. Kijabe section, Kikuyu Escarpment, Kenya. Dorsal views of heads of males (Figs. 1 to 5) and females (Figs. 6 and 7), showing variation in fastigial outline and details. (Greatly enlarged.) Fig. 8.—Lateral view of female (specimen shown in fig. 7). ($\times 2\frac{3}{4}$.)

Parasphena campestris new species. Female (*type*). Between Nanyuki and the upper Guaso Nyiro, Kenya. Fig. 9.—Lateral view. ($\times 2\frac{3}{4}$.)

Parasphena imatogensis new species. Female (*type*). Mt. Kineti, Imatong Mts., Anglo-Egyptian Sudan. Fig. 10.—Lateral view. ($\times 2\frac{3}{4}$.)

Parasphena ruandensis Rehn. Female. Bugoie Forest, Ruanda. Fig. 11.—Lateral view. ($\times 2\frac{3}{4}$.)

Parasphena uvarovi new species. Female (*type*). N'tem Plain, Cameroons. Fig. 12.—Lateral view. ($\times 2$.)

PLATE 27.

Parasphena campestris new species. Female (*type*). Between Nanyuki and the upper Guaso Nyiro, Kenya. Fig. 13.—Dorsal view. ($\times 2\frac{3}{4}$.)

Parasphena imatogensis new species. Female (*type*). Mt. Kineti, Imatong Mts., Anglo-Egyptian Sudan. Fig. 14.—Dorsal view. ($\times 2\frac{3}{4}$.)

Parasphena ruandensis Rehn. Female. Bugoie Forest, Ruanda. Fig. 15.—Dorsal view. ($\times 2\frac{3}{4}$.)

Parasphena uvarovi new species. Female (*type*). N'tem Plain, Cameroons. Fig. 16.—Dorsal view. ($\times 2$.)

Parasphena gallae (Rehn). Male (*type*). Sheikh Husein, Gallaland. Fig. 17.—Dorsal view. ($\times 2\frac{3}{4}$.) Fig. 18.—Lateral view. ($\times 2\frac{3}{4}$.)



13



14



15



18



16



17

REHN: NOTES ON SPECIES OF THE LOCUST GENUS *PARASPHENA*, WITH
DESCRIPTIONS OF THREE NEW SPECIES (ORTHOPTERA,
ACRIDIDAE, PYRGOMORPHINAE)

THE BIRDS OF BOLIVIA. PART I.

BY JAMES BOND * AND RODOLPHE MEYER DE SCHAUSENSEE **

The present report is based primarily on collections made in Bolivia by Melbourne A. Carriker, Jr., who collected there for the Academy from 1934 to 1938. In all 8705 specimens were taken, including a great majority of the forms known from the Republic. Supplementing Carriker's material there are in the Academy 403 specimens taken by José Steinbach, chiefly from the Yungas of Cochabamba and from Buenavista, Santa Cruz. In addition we have a number of d'Orbigny's specimens, for the most part from Chiquitos, in extreme eastern Bolivia, a section of the Republic not visited by Carriker.

Since no comprehensive work on the birds of Bolivia has been published, it was considered advisable to include in this paper all the species known from the Republic, irrespective of whether or not they are represented in the Academy's collection. Thus we hope that this paper will form a useful basis for a future and more thorough report which can only be undertaken when more precise distributional data are available.

We began our study of the collection with the Passeriformes in order to take advantage of the recent revisionary work of Hellmayr (Cat. Birds of the Americas, Field Mus. Nat. Hist. Pub., Zool. Ser., vol. 13), and of Zimmer (Amer. Mus. Novitates) which have been to us of inestimable value. We have as far as possible followed Hellmayr in his systematic arrangement. In only a very few instances have we differed in opinion from this distinguished ornithologist.

A great many of the historic types of d'Orbigny and Lafresnaye came from Bolivia. Largely because of the work they did many years ago more has been known of the birds from this country than of the more northern republics of South America. However, much more intensive collecting remains to be undertaken before the bird-life of Bolivia can be considered well known from a distributional standpoint; and at present almost nothing is known of the life histories of its birds.

A large and modern collection of Bolivian birds made by José Steinbach is to be found in the Carnegie Museum at Pittsburgh, and a collection of more than 9000 skins, chiefly from the Department of El Beni, has recently (1937-1939) been obtained for the Royal Natural History Museum in

* Associate Curator, Birds of the Americas;

** Curator, Department of Birds, The Academy of Natural Sciences of Philadelphia.

Stockholm. Reports on these collections, other than descriptions of new birds, have not yet been published. Doubtless a number of forms will be found in them which have not yet been recorded from Bolivia.

Before closing this introduction we wish to thank Mr. John T. Zimmer, of the American Museum of Natural History, for his help and advice, so graciously offered, as well as for the loan of much extralimital material necessary for comparison. Also, we wish to congratulate Mr. M. A. Carriker, Jr. for the splendid work which he has accomplished in procuring for this Academy what is perhaps the most complete collection of the birds of Bolivia in the world.

The Academy owes an immense debt of gratitude to the American Philosophical Society and to Mr. Charles M. B. Cadwalader, President of the Academy of Natural Sciences of Philadelphia, without whose financial support it would have been impossible to have made the Bolivian collection.

GEOGRAPHY

Bolivia is the third largest republic in South America. It covers an area estimated at 640,000 to 705,000 square miles. Although usually thought of as entirely mountainous, the eastern regions (three-fifths of the whole) are composed of low alluvial plains, gently undulating forested terrain, and vast marshlands. The mountainous country occupies the western section of the Republic and is composed of two great parallel mountain chains between which lies the vast Bolivian table-land or *alta-planicie*. This extends from the Vilcanota Knot in Peru southward to the Serrana de Lipez in Potosí on the Argentinian frontier. At Lake Titicaca the *alta-planicie* has an elevation of 12,650 feet and slopes imperceptibly downward to the southern margin where it is only 1000 feet lower. The northern end of this great plateau is bleak and inhospitable; its southern end, barren and arid. West of Uyuni in Potosí is the great Salar de Uyuni, a huge salt plain, flooded in the rainy season. To the west of the *alta-planicie* lie the Andes which form the Chilean border. The highest peak is Huallatiri which rises to 21,654 feet, but seven others attain altitudes of more than 19,000 feet. The eastern rampart of the *alta-planicie* is known as the Cordillera Oriental which extends northwestward into Peru and is there known as the Sierra de Carabaya. The Sierra Oriental is a rather broken chain extending southward to the vicinity of Sucre.

The main mountain system is called the Cordillera Real and is one of the most imposing snow-capped mountain masses in the world. It is dominated by four great volcanoes, Illimani (21,204 ft.), Illampu or Sorata (21,060 ft.), Chachacomani (21,434 ft.), and Cacaaca (20,571 ft.). Other spur ranges extending southward from it are the Frailes and the Sierra de Chichas which form the eastern wall of the great plateau. To the east of Cochabamba city is the Sierra de Cochabamba which extends in a south-

easterly direction. Between this range and the Cordillera Real is a plateau region broken up by mountains and deep ravines. In Tarija is a range known as the Sierra de S. Victoria which extends southward into Argentina.

Apart from the Andean system, the Sierra de Chiquitos in the northeast of the country is an old, low and broken gneiss range, probably part of the South Brazilian mountain chain, but now separated from it. These mountains, or rather hills, rise to their highest point at Cochii (3894 ft.). They are wooded and lie among the upper affluents of the Rio Mamoré and Rio Guaporé in the llanos of Chiquitos which have a more diversified topography than the rest of the llanos of eastern Bolivia.

The rivers of Bolivia fall into three distinct systems. The northern rivers, such as the Beni, the Mamoré, and the Guaporé, draining northwards, eventually into the Amazon. The rivers on the east and southeast of the country, such as the Pilcomayo and Bermejo, drain into the Rio de la Plata. The rivers of the alta-planice, such as the Desaguadero which drains into Lake Titicaca, and the Rio Ahuira into Lake Poopó, today have no surface outlet but once drained to the eastward. Others, such as the Rio Lipéo which flows northward into the Salar de Uyuni, disappear through evaporation and into the ground.

There are several large lakes in Bolivia, on the alta-planice and in the northern parts of the country. The largest lake entirely in Bolivia is Lake Poopó which extends north and south for a distance of about 75 miles and is over 25 miles in breadth at its widest point. Part of the northern boundary is formed by the huge Lake Titicaca, most of which lies in Peru.

As may well be imagined, every type of climate is to be found in Bolivia from an arctic one on the snow-capped peaks to a tropical one in the low hot valleys.

The section of Bolivia known as the Yungas is the foot-hill country of Cochabamba and La Paz, with altitudes ranging from 1000 feet up to about 5000 feet, where the climate is suitable for growing cocoa and coffee.

Immediately following will be found a list of Bolivian localities which are alluded to in the present paper. Included are all those visited by Carriker. In order that these may be readily found, we have referred to them as being so many miles from localities such as Lake Poopó, Sucre, etc., which are shown on any map of the country.

COLLECTING STATIONS

1. AZERO, RIO (4000 ft.), Chuquisaca. An affluent of the Rio Grande about 90 miles east of Sucre. Carriker collected near the river, not far from and to the east of Padilla. Nov. 21-28, 1936. 116 specimens.
2. BELLAVISTA (10,000 ft.), La Paz. About 30 miles north of La Paz city.

3. BERMEJO (1350 ft.), Tarija. On the Rio Bermejo (Argentine frontier), 40 miles south of Tarija city. Also spelled Vermejo. In the foothill country; heavily wooded. Sept. 7-15, 1936. 159 specimens, 76 species.
4. BUENAVISTA (about 3000 ft.), Santa Cruz. 40 miles northwest of Santa Cruz city on the Rio Surutú.
5. CAIZA (about 2000 ft.), Tarija. About 75 miles east of Tarija city.
6. CALABATEA (4500 ft.), La Paz. About 40 miles north of La Paz city, between La Paz and Rio Coroico. A rainy and foggy locality in which good forest was found. July 9, Nov. 7-21, 1934. 165 specimens.
7. CALACOTO (10,900-12,600 ft.), La Paz. A village in a small irrigated valley about 65 miles southwest of La Paz city where the Railroad line crosses the Rio Desaguadero. Jan. 23-28, 1935. 126 specimens.
8. CALLIPAMPA (12,150 ft.), Oruro. On the Railroad on the east shore of Lake Poopó between Pazña and Poopó stations at the north end of the lake. The country slopes gently upward for about five miles where it meets low mountains. These valleys are steep with much rocky out-cropping. The vegetation consisted of a certain amount of low bushes and much bunch grass. Carriker collected also on the shores of the lake May 30-June 10, 1936; Mar. 6-13, 1938. 242 specimens, 37 species.
9. CATAVÍ (12,400 ft.), Potosí. About 25 miles due east of the northern extremity of Lake Poopó. A camp of the Patino Mines in a deep valley almost devoid of vegetation except for sparse, low grass. Ground very rocky. May 5-13, 1936; May 16-22, 1936. 225 specimens, 50 species.
10. CERDAS (12,750 ft.), Potosí. About 10 miles north of Uyuni or 60 miles due south of the south shore of Lake Poopó. A hamlet visited especially for rheas; only five were seen. Somewhat rough, rolling country, with much Tola in the valleys. Higher portions mostly covered with tough thorny plants, with a little Puna grass and Tola. Feb. 19-20, 1936. 10 specimens, 6 species.
11. CERRO DEL JUNO (12,500-14,600 ft.), Cochabamba. Peaks on the crest of the range about 12 miles northeast of Tiraque or about 40 miles east of Cochabamba city. A locality visited by Steinbach as well as by Carriker. Birds were collected by Carriker on the west side of the range which is much drier than the east slope where Steinbach collected. Heavy snow fell on the crest of Cerro del Juno on Oct. 4, 1937. See also Tiraque.
12. CERRO HOSORNE (4000 ft.), Santa Cruz. A Steinbach locality in Santa Cruz.
13. CHALUANI, RIO, Cochabamba. Half way between Totorá and Ele-Ele.
14. CHAPARE, RIO. See Mouth of the Chapare.

15. CHATARONA (600 ft.), Beni. On the Rio Beni, between Susi (= Rurrenbaque) and Reyes, about 130 miles north-northeast of La Paz. The point farthest north at which collections were made on the Beni River. Savanna country with patches of forest and marshy areas near the river. Climate very hot. Sept. 16-30, 1934. 326 specimens, 150 species.
16. CHINIRI (1125 ft.), La Paz. At the juncture of the Rio Kaka and the Rio Mapiri, between Huanay and Mapiri, 80 miles north and a little east of La Paz city. Forest and savanna. Aug. 23-Sept. 6, 1934. 258 specimens.
17. CHIQUITOS, Santa Cruz. A llano district east of Santa Cruz city, between 600 and 1000 feet.
18. CHOCAYA (13,000-14,000 ft.), Potosí. A tin mine 4 or 5 miles from the railroad station of Oploca, 25 miles north of the border of Jujuy, Argentina. It is situated on a stream running into the Pilcomayo. Very arid; thorn and cactus vegetation; ground covered with small, loose stones. Birds scarce and few species. June 14-18, 1936; Feb. 17-18, 1938. 127 specimens, 17 species.
19. CHORROS (11,000 ft.), Cochabamba. Near Cochabamba city. Jan. 4-15, 1937. 103 specimens.
20. CHULUMANI (10,000 ft.), La Paz. About 45 miles due east of La Paz city. The capital of Yungas Province.
21. CIRCUTA, La Paz. A d'Orbigny locality, about 80 miles east and slightly south of La Paz city.
22. COCHABAMBA CITY, Cochabamba. The capital of the department.
23. COHONI, La Paz. 30 miles southeast of La Paz city.
24. COLOMI, Cochabamba. About 70 miles northeast of Cochabamba city.
25. COROICO, RIO (2200 ft.), La Paz. At the end of the railroad about 25 miles northeast of La Paz city (see Santa Ana).
26. CUCHACANCHA (11,000 ft.), Cochabamba. About 40 miles due east of Cochabamba city. Also known as Aguirri.
27. ELE-ELE (5000 ft.), Cochabamba. A small hamlet on the Rio Mizque about 55 miles southeast of Totora, 20 miles from the border of Santa Cruz Province. The Rio Chulumani, where d'Orbigny collected, lies halfway between Totora and Ele-Ele. Carriker says of this locality, "I never saw any place in all my travels where xerophytic vegetation was so abundant as here." Beside thorny scrub and a tremendous variety of cacti, some 40 feet tall, there were large patches of bromelia-like plants on the ground, which was sandy and covered with stones. Above Ele-Ele (at 8000 ft.), there were a fair number of trees 30 to 40 feet in height. Carriker says this region is cut off from the northeast winds and the rains which fall on the Yungas

- by a high range of mountains which extend east from Tiraque nearly to Santa Cruz. This explains the abrupt change in fauna and flora between northeast and southeast Cochabamba. The weather here was clear and hot. Oct. 8-17, 1937. 251 specimens, 75 species.
28. EL PONGO (12,000 ft.), La Paz. On the Yungas Railroad about 35 miles northeast of La Paz city. A cold, rainy, and foggy locality. On January 2 the maximum temperature was 47, minimum 45. Jan. 1-3, 1935. 26 specimens.
29. ENTRE RIOS (4600 ft.), Tarija. 65 miles east of Tarija city between the Rios Santa Ana and Salinas. A small town situated in a rather wide valley on a considerable area of low, level land which is irrigated. The streams in the pastures are lined with acacias. A short distance from the town, mountains rise steeply for over 2000 feet; where not too steep the forest has been cleared. The wet season is from November to April. During Carriker's visit there were heavy frosts and almost all the trees had dropped their leaves. In the day time it was clear and hot with occasional rain and hail. Oct. 17-23, 1936. 192 specimens, 82 species.
30. FORTÍN CAMPERO (1150 ft.), Tarija. Southernmost point in Bolivia at the juncture of the Rios Bermejo and Tarija. The country here was entirely flat and the forest very much burnt. Minimum temperature 48; maximum temperature 97. Sept. 16-23, 1936. 144 specimens, 64 species.
31. GUARAYOS, Santa Cruz. The llanos at the extreme north of Santa Cruz.
32. HICHULOMA (10,700 ft.), La Paz. On the Yungas Railroad about 30 miles northeast of La Paz city. A cold, foggy, and rainy locality. Dec. 20, 1934-Jan. 1, 1935. 224 specimens.
33. HUANAY (1500 ft.), La Paz. On the Rio Mapirí about 120 miles east of the north end of Lake Titicaca. Thick forest with much undergrowth and vines, interspread with areas of savanna. Aug. 6-18, 1934. 135 specimens.
34. INCACHACA (8000 ft.), Cochabamba. On the west slope of the mountains a few miles north of Colomi. Forest and boggy meadows. Considerable rain and fog. According to Carriker this is the same as Aduana. Apr. 8-23, 1937; May 7-June 13, 1937. 504 specimens.
35. INQUISIVI, La Paz. In the southeast of La Paz about 25 miles from the Cochabamba border.
36. KAKA, RIO, La Paz. A stream flowing into the Rio Beni, about 100 miles north-northeast of La Paz city.
37. KARI-KARI Mts. (14,000-16,500 ft.), Potosí. A short range rising to the east of Potosí city and extending southward. This range is surmounted in its centre by a group of jagged, rocky pinnacles which

attain a height of about 16,500 feet. The range is cut up by a series of valleys, in each of which are one to three lakes. *Phegornis mitchelli* was present in small numbers. At the heads of the valleys the temperatures fell to below freezing at night. Three trips were made to this range between January 20 and 27. This was supposed to be the rainy season, but it was unusually dry during Carriker's visit. See Potosí.

38. LA CUMBRE (15,000-16,000 ft.), La Paz. A locality on the crest of the mountains about 15 miles northwest of La Paz. On January 5 the temperature fell to below freezing, and on January 11 there was an inch of snow on the ground with the temperature at 34°. In addition to snow, rain and fog were encountered. Jan. 4-5, 11-14, 1934. 72 specimens.
39. LAGUNILLAS (3500 ft.), Santa Cruz. A small village situated in a valley at the east foot of a high range of mountains. The town is about 150 miles east of Potosí city, in the southwest corner of Santa Cruz. The surrounding country is very dry, but there are a few small springs which disappear into the sandy soil, and the ground is cleared and planted with corn where irrigation is possible. However, in spite of the general aridity, large areas are covered with acacias, and other trees, and much low, thorny scrub. Nov. 11-16, 1936. 110 specimens, 66 species.
40. LARECAJA, La Paz. A province, the capital of which is Sorata, north of La Paz city.
41. LIPEO, RIO (2000 ft.), Tarija. In southern Tarija a few miles from the Argentine border. Here the Rio Lipeo meets the Rio Candado, and the two form the Rio Bermejo. Carriker collected at a farm called Monte Bello. The region of the Rio Lipeo appeared to Carriker to have a heavier rainfall than any of the surrounding country. The forests were extensive and very luxuriant. The water of the Rio Lipeo was clear and cold. On several nights the temperature fell to below freezing. Aug. 11-28; Oct. 1-3, 1936. 375 specimens, 83 species.
42. LA COCHA, La Paz. Between Santa Ana and Huanay. Carriker stopped here Aug. 4, 1937. 1 specimen.
43. LA MERCED (5500 ft.), Tarija. A hamlet on the Rio Chachimayo, about 50 miles south of Tarija city, near the border of Jujuy, Argentina. It lies in a deep but narrow valley with mountains rising steeply on both sides. The upper parts of the mountains are bare, the lower slopes sparsely covered with scattered trees and shrubbery which were dry and leafless. Green trees were found only on the floor of the valley. Oranges and grapes were grown here where irrigation was possible. July 26-Aug. 1, 1935. 164 specimens, 56 species.

44. LLALLAGUA (13,000-14,500 ft.), Potosí. Just across the border from Oruro, very near Uncia, and 25 miles due east of the northern end of Lake Poopó. Although what was supposed to have been the rainy season had just ended, the surrounding country was very dry because of an unseasonal drought. To the east the ground slopes to a large pampa, then breaks off into a deep valley. During his stay here Carriker made frequent visits to nearby Catavi. May 5-25, 1936. 124 specimens, 39 species.
45. LLICA (12,100 ft.), Potosí. An Aymara village 100 miles northwest across the Salar from Uyuni and 18 miles from the border of Chile. This whole region is extremely dry with very little surface water, most of which is brackish. The mountains around Llica to the west are very rocky while to the east extends a large pampa. On two successive days the temperature fell to below freezing and ice was noticed. Feb. 6-10, 1938. 64 specimens, 18 species.
46. MAPIRÍ, RIO (1500 ft.), La Paz. A stream flowing into the Kaka, an affluent of the Beni, about 100 miles east of the northern end of Lake Titicaca. See Huanay.
47. MIZQUE, RIO, Cochabamba. One of the streams forming the headwaters of the Rio Grande—Rio Guaporé. See under Ele-Ele.
48. MOJOS, Santa Cruz. The llanos in northern Santa Cruz, between the Rio Mamoré and the Matto Grosso border. Also spelled Moxos.
49. MONTE BELLO, Tarija. See Rio Lipeo.
50. MOUTH OF THE CHAPARE (825 ft.), Beni. Juncture of the Chapare and Mamoré. Thick forest with many Caroba palms. Across the Chimoré there was a large tract covered with coarse grass interspersed with scattered willow-like trees and patches of cane. The forest was materially different in character from that at Todos Santos, a few miles to the south, probably due to less rain and a longer dry season. There were many Yuracarés Indians in the vicinity. Carriker reported seeing porpoises here. Aug. 16-31, 1937. 291 specimens, 107 species.
51. OPLOCA (11,000 ft.), Potosí. 52 miles south of Uyuni, 9 miles north of Tupiza. The valley in which Oploca is situated is wide and well irrigated, but is enclosed by precipitous cliffs. Where not cultivated it was thickly overgrown with five- to six-foot thorny scrub and cactus. Finca Saló is another section of Oploca in a valley a few miles to the east. Here there was less thorn bush, more pasture land and a certain amount of marsh. The temperature was below freezing at night. June 20-July 2, 1936; Feb. 24-Mar. 2, 1938. 383 specimens, 89 species.
52. ORURO (13,800 ft.), Oruro. The capital of the Department of Oruro, about 30 miles due north of Lake Poopó.

53. PADILLA (7100-10,000 ft.), Chuquisaca. About 70 miles east-southeast of Sucre, the capital of Bolivia, 20 miles southeast of Tomina. Dec. 31, 1937-Jan. 8, 1938. 149 specimens, 58 species.
54. PALCA, Cochabamba. In the province of Ayupaya about 35 miles northwest of Cochabamba city.
55. PALMAR (2600-4500 ft.), Cochabamba. On the Amazonian watershed on the east slope of the mountains. The town is on the Rio San Mateo, an affluent of the Rio Chapare and about 70 miles east of Cochabamba city. The Yungas of Cochabamba are very much more humid than the Yungas of La Paz, at least in the region of the Rios Mapiri, Kaka, Coroico, and upper Beni. The winter months, June, July, and August, are very rainy. During the month spent at Palmar there were not more than nine days of sun. The forest was very dense with tall trees and much undergrowth; everything was covered with moss and epiphytes. The natives said that there was much fog throughout the year. There was a little cultivation around Palmar proper. The lowest temperature during Carriker's visit was 50, the maximum 77. July 1-28, 1937. 420 specimens, 127 species.
56. PALMARITO (1200 ft.), Santa Cruz. In the Chiquitos district about 50 miles northeast of Santa Cruz city.
57. PAZÑA, Oruro. On the railroad toward the northern end of Lake Poopó.
58. PIEDRAS BLANCAS (5000 ft.), Santa Cruz. A morning's walk from Samaipata. A gently sloping valley, practically bare of vegetation other than grass on the south slope, the north slope heavily wooded with luxuriant, humid forest. One of the most productive localities. Although close to Samaipata the vegetation is very different, not arid. Birds from this locality are included with the ones from Samaipata. Nov. 1937.
59. POCONA (8500 ft.), Cochabamba. A few miles west of Totora.
60. POOPÓ LAKE (12,000 ft.), Oruro. The largest lake in Bolivia.
61. POTOSÍ (13,800 ft.), Potosí. The capital of the department. About 60 miles east and slightly south of the southern end of Lake Poopó. Owing to four centuries of mining operations most of the vegetation nearby has been destroyed. Jan. 19-27, 1938. 164 specimens, 35 species, including those from Kari Kari Mountains.
62. PUERTO BALLIVIAN, La Paz. On the Rio Kaka, just below Huanay.
63. PULACAYO (13,400 ft.), Potosí. A mine 20 miles due east of Uyuni by motor. Very dry, no running water and but few springs. Feb. 12, 1938. 13 specimens, 9 species.
64. REYES, Beni. A few miles back from the east bank of the Beni River and about 20 miles northeast of Susi.
65. RURRENABAQUE, Beni. See Susi.

66. SAN ANTONIO (2000 ft.), Cochabamba. On the upper Rio Chapare a few miles northwest of Palmar.
67. SAN CRISTOBAL (8500-8900), Cochabamba. Near Cochabamba city. Jan. 21-30, 1937. 98 specimens.
68. SAN JACINTO (6600-8500 ft.), Cochabamba. About 10 miles north of Incachaca on the west side of the mountains. Apr. 27-May 5, 1937. 106 specimens.
69. SAN JOSÉ, Cochabamba. On the Rio Mizque. A locality visited by Garlepp.
70. SAN LORENZO (7500 ft.), Tarija. A mountain locality, about 15 miles due north of Tarija city, with fruit orchards. Corn, wheat, barley, potatoes, peas, and grapes are also grown. Where there is no irrigation the ground is dry and covered with thorn bush. The higher levels above the village are broken by deep ravines. Although the days were warm there was usually heavy frost at night. Jan. 8-19, 1936. 262 specimens, 61 species.
71. SAN MATEO, Cochabamba. In Yuracarés Province in northern Cochabamba. A locality visited by d'Orbigny, a few miles east of Totora.
72. SANTA ANA (2200-3000 ft.), La Paz. On the Rio Coroico. July 11-Aug. 2, 1934. 385 specimens, 142 species.
73. SANTA ROSA, Cochabamba. Just south of Todos Santos on the Rio Chapare.
74. SANTO CORAZÓN. A mission station in eastern Santa Cruz 280 miles east by a trifle south of Santa Cruz city.
75. SAJAMÁ, Oruro. About 5 miles from the border of Chile in northwest Oruro.
76. SAMAIPATA (5500 ft.), Santa Cruz. About 60 miles southwest of Santa Cruz city. Sometimes spelled Samaypata. Across the range of mountains from Ele-Ele. The original woodland has mostly disappeared except at the head of some small valleys. The vegetation consists of second growth scrub, acacia, and thorny bushes with a thick growth of grass which would form good grazing except for the lack of water. During Carrier's stay the minimum temperature was 52, the maximum 81. Oct. 26-Nov. 27, 1937. 522 specimens, 152 species, including those from Piedras Blancas.
77. SANDILLANI (6800 ft.), La Paz. On the Yungas Railroad a few miles north of La Paz on the old Yungas trail. Forest and grassy slopes. A fairly rainy and foggy locality. Nov. 22-Dec. 19, 1934. 318 specimens, 78 species.
78. SARA, Santa Cruz. The Province just north of Santa Cruz city.
79. SICASICA, La Paz. On the railroad about 60 miles south and a little west of La Paz city.

80. SORATA, La Paz. About 25 miles from Lake Titicaca on a line with Puno, Peru.
81. SURUTÚ, Río, Santa Cruz. A river starting in the mountains a few miles west of Santa Cruz city, flowing northward into one of the affluents of the Río Guaporé.
82. SUSI (950 ft.), Beni. Called Rurrenabaque on some maps. 10 miles north of the juncture of the Kaka and the Beni, about 25 miles southwest of Reyes. Near a range of low hills. The vegetation here was mixed forest and savanna. Sept. 11-15, 1934. 102 specimens.
83. TANAPACÁ (10,600-13,500 ft.), La Paz. A farm in the valley below Viloca about 40 miles southeast of La Paz city in the eastern cordillera. Mar. 31-Apr. 8, 1938. 108 specimens, 40 species.
84. TEOPONTE (2425 ft.), La Paz. On the south bank of the Río Kaka, a little north and east of Huanay. Forest and savanna with large open flats running back to the hills. Aug. 15-20, 1934. 110 specimens.
85. TILOTILO (7000 ft.), La Paz. Near Sandillani.
86. TIPUANI, La Paz. 70 miles due north of La Paz city.
87. TIRAQUE (10,700-12,500 ft.), Cochabamba. A rather large village about 45 miles due east of Cochabamba city on the west slope of the eastern cordillera. The whole region is mountainous, rather rolling on the west slope but very bare and rocky in most places. Areas nearly free from stones were planted with wheat, barley, and potatoes. Stunted trees are found in the valleys. Sept. 26-Oct. 4, 1937. 215 specimens, 65 species including those from Cerro del Junco.
88. TODOS SANTOS (1000 ft.), Cochabamba. On the Río Chapare about 100 miles northeast of Cochabamba city. Two days by mule northwest of Palmar. Flat country, fine virgin forest, with a few small clearings near the river. At the head of navigation for small steamers and launches. July 31-Aug. 12; Sept. 6-11, 1937. 374 specimens, 151 species.
89. TOMINA (6700 ft.), Chuquisaca. About 55 miles southeast of Sucre on the road to Padilla, 80 miles east of Cochabamba. Hills rise rapidly close to the village on the west side. A river on the east flows into the Río Grande. Deep, narrow valleys run back into the hills; behind these, mountains rise to not less than 10,000 feet. The vegetation is composed of heavy growth of thorny trees, bushes and cacti; the ground is rocky and arid. A collection was also made in the valley behind the first range of low hills, the bottom of which is heavily wooded. At the head of the valley at about 8000 feet the cactus almost disappeared and large trees grew. The fauna was found to be quite different from that of lower altitudes. Dec. 21-30, 1937. 158 specimens, 76 species.
90. TOTORA, Cochabamba. 50 miles southeast of Tiraque on the east slope of the Sierra de Cochabamba.

91. TUPIZA, Potosí. On the railroad in southeastern Potosí just north of Oploca.
92. TUTIMAYO (10,500 ft.), Cochabamba. Near Cochabamba city. Mar. 2-10, 1934. 102 specimens.
93. UNCIA (13,100 ft.), Potosí. On May 24 Carriker collected near two small lakes about 10 miles southeast of Uncia. See Llallagua.
94. UNDUAVI, La Paz = Hichuloma (Carriker).
95. UYUNI (12,100 ft.), Potosí. Juncture of railroad branching to Antofagasta, 80 miles due south of Lake Poopó. On a vast plain with a range of low mountains to the east, which extend to the eastern Cordillera. Jan. 29-Feb. 5, 1938. 125 specimens.
96. VACAS, Cochabamba. 30 miles southeast of Cochabamba city.
97. VALLE GRANDE, Santa Cruz. A town about 80 miles southeast of Santa Cruz city.
98. VILLA MONTES (2000 ft.), Tarija. On the Rio Pilcomayo 80 miles northeast of Tarija city. The portion of the town on the north bank of the river was formerly known as San Francisco, that on the south bank San Antonio. The town lies in a horseshoe-shaped plain encircled by hills with higher mountains behind these to the west. The foothills are heavily wooded, with a certain amount of thorny undergrowth. East of the town a flat unbroken bush-land extends from the river bank to low hills. The trees, mostly acacia, were in fresh leaf during Carriker's visit. Minimum temperature 60, maximum in the shade 109. Carriker was informed that the vegetation further out on the Chaco was practically the same as that near Villa Montes but possibly more luxuriant. Oct. 29-Nov. 9, 1936. 226 specimens, 91 species.
99. VILOCA (13,800-17,000 ft.), La Paz. About 40 miles southeast of La Paz city in the eastern Cordillera. Situated in a deep valley at the head of which are snow-capped peaks, about 18,000 feet in height, and large glaciers. The peak of Illimani lies southwest across the valley. The weather was, for the most part, very foggy with occasional showers. The mountain slopes are covered with very short grass and minute plants. On the slopes with no rocks birds seemed absent. High up on the sides of the valleys puna grass and low bushes grew. Mar. 28-30, 1938. 76 specimens, 19 species.
100. YACUIBA, Tarija. Near the Argentine frontier 75 miles southeast of Tarija city.
101. YUNGAS DE COCHABAMBA. The northeastern slope of the mountains between 1000 and 5000 feet. These yungas are much more humid than those of La Paz.

102. YUNGAS DE LA PAZ. The north slope of the mountains between 1000 and 3000 feet.
103. YURACARÉS, Cochabamba. A province north of Cochabamba on the Amazonian slope of the mountains.
104. ZONGO, La Paz = Songo, 30 miles north of La Paz city.

ANNOTATED LIST

Order PASSERIFORMES (Suborder MESOMYODI)

Family PTEROPTOCHIDAE (Tapacolas)

Scytalopus femoralis bolivianus Allen

2 ♂ ; Calabatea, Sandillani.

Scytalopus magellanicus simonsi (Chubb)

13 ♂ , 14 ♀ , 3 o; Hichuloma, Sandillani, Tanapacá, Viloca, Cerro del Juno, Chorros, Incahaca, San Cristobal.

This race, not recognized by Zimmer in his recent revision of some forms of the genus *Scytalopus* (Amer. Mus. Novit., no. 1044, 1939, p. 13), was described by Chubb from Choqueamate (4000 metres), Cochabamba (Bull. Brit. Orn. Club, 38, 1918, p. 17). We find that the above series differs from two birds from Limbani, Peru, identified by Zimmer as *S. m. acutirostris* (Tschudi), in that the rufous of the posterior under parts is much duller. Chubb did not separate this bird on the above character and compared it only with *silvestris* (= *S. latebricola meridanus* Hellmayr). He described it as having "a whitish eye-brow," a character present in our specimens.

Scytalopus superciliaris zimmeri Bond and de Schauensee

Not. Naturae, no. 44, April 5, 1940, p. 1 (Padilla, 8200 ft., Dept. Chuquisaca).

3 ♂ , ♀ ; 25 km. east of Padilla.

Family CONOPOPHAGIDAE (Gnat-eaters)

Conopophaga ardesiaca ardesiaca Lafresnaye and d'Orbigny

4 ♂ , 7 ♀ ; Calabatea, Sandillani, Palmar, Rio Azero.

A single male from the Rio Azero has more white on the abdomen than have males from La Paz and Cochabamba.

Conopophaga melanogaster Ménétriers

Recorded from Reyes, on the Rio Beni.

Corythopsis delalandi (Lesson)

Recorded from Chiquitos.

Corythopsis torquata subtorquata Todd

Proc. Biol. Soc. Wash., 40, 1927, p. 151 (Rio Yacapani, Bolivia).

♂ ; Teoponte.

Family **FORMICARIIDAE** (Antbirds)**Cymbilaimus lineatus sanctaemariae** Gyldenstolpe

Arkiv för Zool., 33 B, no. 13, 1941, p. 6 (Victoria, confluence of Rio Madre de Dios, Bolivia).

Known only from the type locality.

Cymbilaimus lineatus intermedius (Hartert and Goodson)

2 ♂ ; Chiniiri, Santa Ana.

New to Bolivia. These birds appear indistinguishable from the widespread *intermedius*. The Chiniiri specimen is not fully adult, showing some white on the pileum, while the barring on the inner remiges is ochraceous-buff, this color being also present on the upper and under tail-coverts.

Batara cinerea argentina Shipton

♂, 3 ♀ ; Bermejo, Rio Lipeo.

A well characterized race, which has not hitherto been recorded from Bolivia. Wing, ♂ 113, ♀ 111, 112, 115 mm.

Batara cinerea excubitor Bond and de Schauensee

Not. Naturae, no. 44, April 5, 1940, p. 2 (Samaipata, Dept. Santa Cruz, Bolivia).

♂, 2 ♀ ; Samaipata.

Taraba major major (Vieillot)

8 ♂, 11 ♀ ; Chatarona, Susi, Chiniiri, mouth of the Rio Chapare, Todos Santos.

T. m. kriegi Laubmann from Santa Cruz is considered synonymous with the present form in the Hornero (Lista Sist. Aves Argentinas, 7, 1938, p. 118). We have seen no specimens of the species from this Department (vide Amer. Mus. Novit., no. 668, 1933).

Thamnophilus doliatus signatus Zimmer

Amer. Mus. Novit., no. 646, 1933, p. 5 (Santarem, Brazil).

7 ♂, ♀ ; Chatarona, mouth of the Rio Chapare, Todos Santos.

Thamnophilus doliatus radiatus Vieillot

♂ ; Lagunillas.

This example agrees closely with specimens from Matto Grosso.

Thamnophilus doliatus cadwaladeri Bond and de Schauensee

Not. Naturae, no. 44, April 5, 1940, pp. 2, 3 (Villa Montes, 2000 ft., Dept. Tarija, Bolivia).

♂, 2 ♀ ; Villa Montes.

This form is decidedly less heavily banded below than *radiatus*, resembling most closely *Th. d. palamblae* Zimmer.

Thamnophilus palliatus puncticeps Slater

4 ♂, 5 ♀ ; Chatarona, Calabatea, Todos Santos, mouth of the Rio Chapare.

***Thamnophilus aethiops kapouni* Seilern**

2 ♂ ; Susi, Todos Santos.

***Thamnophilus schistaceus schistaceus* d'Orbigny**

16 ♂, 15 ♀ ; Chatarona, Susi, Chiniñiri, Huanay, mouth of the Rio Chapare, Palmar, Santa Ana, Todos Santos, Teoponte.

***Thamnophilus aroyae* (Hellmayr)**

7 ♂, 8 ♀ ; Palmar.

The "female" recorded by Zimmer from the Yungas of Cochabamba is, we believe, an immature male. The middle and greater wing-coverts are finely tipped with white, an adult male character, which is entirely lacking in our series of females from the same region. Furthermore the white concealed dorsal patch, present in the American Museum specimen, is either absent or but faintly indicated in our females. Our males, all of which are apparently adult, usually have such a patch either well defined or at least evident, although several lack all traces of white in this area. Bolivian males have more white on the average than do those from Peru. Females from Bolivia appear indistinguishable from Peruvian specimens.

***Thamnophilus punctatus sticturus* Pelzeln**

1 ♂, 3 ♀, o; mouth of the Rio Chapare, Buenavista.

***Thamnophilus amazonicus amazonicus* Sclater**

Recorded from the "Yungas" = lower Beni? (Rusby specimen).

***Thamnophilus caerulescens dinellii* Berlepsch**

28 ♂, 14 ♀ ; Ele-Ele, Tomina, Rio Azero, Entre Rios, Fortín Campero, Bermejo, Rio Lipeo, Villa Montes, Yacuiba.

Strangely enough, males from Ele-Ele (Rio Mizque, Dept. Cochabamba) have the anterior under parts paler, less washed with dusky than the majority of specimens of *dinellii* from extreme southern Bolivia (Dept. Tarija), none of the birds showing an approach to the black-breasted specimens from Samaipata (*connectens*). One specimen from the Rio Lipeo (Dept. Tarija) shows a definite trend toward *connectens*, with a conspicuous dusky, but not black, pectoral band. In this connection it should be mentioned that *connectens* has recently been recorded from northern Argentina (Zotta, Nuevas Adiciones a la Avifauna Argentina, El Hornero, 7, 1938, pp. 61-62), but the illustration shows a bird different from our Samaipata specimens. It would appear that *dinellii* is likewise variable although less so than *connectens*.

***Thamnophilus caerulescens connectens* Berlepsch**

15 ♂, 11 ♀ ; Samaipata.

Ten males of this puzzling form have considerable black on the anterior under parts, forming more or less well defined black pectoral bands. The

remainder, apparently adult birds, lack these black markings and are virtually indistinguishable from *dinellii*. We do not consider that two species occur side by side at Samaipata, but are inclined to believe that one highly dimorphic race is represented. Those males with the blackest breasts show an approach to the more northern *aspersiventer* but are at once distinguishable. The last mentioned race, which is very distinct, has not been taken at Samaipata so that *aspersiventer-dinellii* hybrids are highly improbable. Allowing for individual variation, the 11 females are more uniform than the males. They resemble females of *dinellii*, taken in the Departments of Chuquisaca and Tarija, but have on the average less black on the pileum.

Two females from Ele-Ele, Dept. Cochabamba, about 80 miles west of Samaipata, resemble southern birds (*dinellii*) in having considerable black on the pileum.

Thamnophilus caerulescens aspersiventer Lafresnaye and d'Orbigny

Thamnophilus aspersiventer steinbachi Carriker, Proc. Acad. Nat. Sci. Phila., 83, 1931, p. 464 (1932) (Incachaca, Dept. Cochabamba, Bolivia).

26 ♂, 13 ♀; Sandillani, Incachaca, Palmar, San Cristobal, Circuata.

These birds vary to such an extent that we do not see how *T. c. steinbachi* Carriker can be maintained as a distinct race. In the above series are two males and two females with d'Orbigny's original labels (Circuata).

Thamnophilus torquatus Swainson

Recorded from eastern Bolivia (plains of Guarayos).

Thamnophilus ruficapillus cochabambae (Chapman)

13 ♂, 11 ♀; Samaipata, Padilla, La Merced, Rio Lipeo, Tarija, Villa Montes.

Thamnophilus ruficapillus subfasciatus Sclater and Salvin

5 ♂, 2 ♀; Sandillani, San Cristobal.

Thamnistes anabatinus rufescens Cabanis

2 ♂, 2 ♀; Palmar.

These birds average slightly more rufescent below than does a series from Peru. The genus has not previously been recorded from Bolivia.

Dysithamnus mentalis tavarae Zimmer

Amer. Mus. Novit., no. 558, 1932, pp. 7-8 (Rio Tavará, 1600 ft., Peru).

8 ♂, 11 ♀; mouth of the Rio Chapare, Palmar, Todos Santos.

Thamnomanes caesius schistogynus Hellmayr

8 ♂, 8 ♀; Chifiriri, Santa Ana, Todos Santos, Teoponte.

Myrmotherula brachyura brachyura (Hermann)

♂, ♀; mouth of the Rio Chapare, Todos Santos.

***Myrmotherula longicauda australis* Chapman**

3 ♂, 4 ♀; Palmar.

***Myrmotherula hauxwelli hauxwelli* (Sclater)**

♂; Chatarona.

This species has not previously been recorded from Bolivia.

***Myrmotherula leucophthalma leucophthalma* (Pelzeln)**

♂; Chiñiri.

This bird, not previously recorded from Bolivia, agrees with the description of the nominate form (rather than with *sororia* Berlepsch and Stolzmann), as does also a specimen from Huacamayo, Peru.

***Myrmotherula ornata meridionalis* Zimmer**

Amer. Mus. Novit., no. 524, 1932, p. 2 (Rio Tavera, 1600 ft., southeast Peru).

6 ♂, 3 ♀; Chiñiri, Teoponte.

***Myrmotherula axillaris axillaris* (Vieillot)**

Zimmer believes birds from the junction of the Beni and Mamoré to be referable to this race. (Amer. Mus. Novit., no. 524, 1932, p. 9). We have no specimens from that far north.

***Myrmotherula axillaris lafresnayana* d'Orbigny and Lafresnaye**

8 ♂, 8 ♀; Chatarona, Chiñiri, Santa Ana, Todos Santos, Teoponte.

***Myrmotherula menetriesii menetriesii* (d'Orbigny)**

10 ♂, 4 ♀; Chiñiri, mouth of the Rio Chapare, Palmar, Santa Ana, Todos Santos, Teoponte.

***Myrmotherula grisea* Carriker**

Proc. Acad. Nat. Sci. Phila., 87, 1935, pp. 321-322 (Santa Ana, Rio Coroico, Dept. La Paz, Bolivia).

3 ♂, 4 ♀; Santa Ana.

This interesting bird is closely related to *M. unicolor* (Ménétrières) from southeast Brazil, a species not mentioned by Carriker in his original description. The males differ from those of *unicolor* in lacking the black throat patch. The female of *grisea* has the upper parts more olivaceous, less rufescent, and the under parts are deep rufous rather than ochraceous-buff. In addition, *M. grisea* is decidedly larger than *M. unicolor*.

M. grisea ♂, wing 55.5-57.5; ♀, wing 54-55.5 mm.

M. unicolor ♂, wing 49-51; ♀, wing 47-49 mm. (Hellmayr).

***Dichrozona cincta* (Pelzeln)**

♀; Santa Ana.

***Melanopareia torquata bitorquata* (Lafresnaye and d'Orbigny)**

Known only from the Chiquitos district.

Melanopareia maximiliani maximiliani (d'Orbigny)

3 ♂ ; Sandillani.

Melanopareia maximiliani argentina (Hellmayr)

4 ♂ , ♀ ; Padilla, Samaipata.

This bird, which is new to Bolivia, differs from our specimens of the nominate form by the characters given by Hellmayr (Cat. Bds. Amer., 13, pt. 3, 1934, p. 168).

Myrmorchilus strigilatus suspicax Wetmore

10 ♂ , 8 ♀ ; Lagunillas, Fortín Campero, Villa Montes, Yacuiba.

Not recorded from Bolivia by Hellmayr (Cat. Bds. Amer., 3, 1924, p. 170).

Herpsilochmus atricapillus Pelzelin

5 ♂ , 4 ♀ ; Lagunillas, Rio Azero, Bermejo, Fortín Campero.

See Naumburg, Bull. Amer. Mus. Nat. Hist., 76, art. 6, 1939, pp. 244-246.

Herpsilochmus rufimarginatus frater Sclater and Salvin

Herpsilochmus rufimarginatus flaviventris Carriker, Proc. Acad. Nat. Sci. Phila., 87, p. 322, 1935 (Teoponte, 1425 ft., Rio Kaka, Dept. La Paz, Bolivia).

3 ♂ , 2 ♀ ; Chiniñiri, Santa Ana, Teoponte.

We have compared these birds with specimens in the American Museum from Zamora, east Ecuador, and a male and female in the Academy's collection from Shapaja, Rio Huallaga, Peru, and find them indistinguishable. There is considerable variation in both males and females in the color of the mantle and among females in the color of the pileum. None of the females, however, has the pileum as dull rufous as in the nominate form. Although Hellmayr considers birds from western Matto Grosso and Peru intermediate between the two above forms, our Peruvian and Bolivian birds show no intermediate characters. Carriker records a male in the Carnegie Museum from the Rio Surutú as nearest to the nominate form.

Microrhophias quixensis bicolor (Pelzelin)

Recorded from the lower Rio Beni.

Formicivora melanogaster melanogaster Pelzelin

6 ♂ , 4 ♀ ; Villa Montes.

Formicivora rufa rufa (Wied)

5 ♂ , 5 ♀ ; Chatarona, mouth of the Rio Chapare.

See Zimmer, Amer. Mus. Novit., no. 538, 1932, pp. 7-9.

Drymophila devillei devillei (Ménégaux and Hellmayr)

3 ♂ , 2 ♀ ; Chiniñiri.

Drymophila caudata caudata (Sclater)

Drymophila caudata boliviana Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 324 (Sandillani, 6600 ft., Yungas de La Paz, Bolivia).

3 ♂, ♀; Sandillani.

On comparison with Colombian specimens we do not see how either *peruviana* Domaniewski and Stolzmann or *boliviana* Carriker can be maintained.

Terenura sharpei Berlepsch

Recorded from the Yungas of Cochabamba.

Cercomacra cinerascens sclateri Hellmayr

3 ♂; Chiniñiri, Huanay, Teoponte.

New to Bolivia. Our birds agree well with Peruvian and Brazilian specimens of this race.

Cercomacra nigrescens fuscicauda Zimmer

Amer. Mus. Novit., no. 500, 1931, p. 13 (Lagarto, Upper Rio Ucayali, Peru).

We have no specimens of this form which has been recorded from Mapi, Todos Santos, and from the mouth of the Rio San Antonio.

Cercomacra serva hypomelaena Sclater

8 ♂, 4 ♀; Huanay, Santa Ana, Teoponte.

Zimmer considers this race recognizable (Amer. Mus. Novit., no. 500, 1931, pp. 11-12).

Cercomacra melanaria (Ménétrières)

3 ♂, ♀; Mouth of the Rio Chapare, Todos Santos.

This species has not previously been recorded from Bolivia. The above specimens in both sexes appear to have smaller white spots on the wing-coverts and on the ends of the rectrices than have specimens from Descalvados, Matto Grosso. They perhaps represent an undescribed race.

Pyriglena leuconota maura (Ménétrières)

♂; Chiquitos (d'Orbigny specimen).

Pyriglena leuconota hellmayri Stolzmann and Domaniewski

13 ♂, 8 ♀; Calabatea, Palmar, mouth of the Rio Chapare, Buenavista, Samaipata.

Birds from the Yungas of Cochabamba resemble those from the Yungas of La Paz and Santa Cruz.

Myrmoborus leucophrys leucophrys (Tschudi)

6 ♂, 6 ♀; Chatarona, Chiniñiri, Todos Santos.

Myrmoborus leucophrys griseigula Zimmer

Amer. Mus. Novit., no. 545, 1932, pp. 3-4 (Rosarinho, Lago Sampaio, left bank of Rio Madeira, Brazil).

Recorded from Reyes and the lower Rio Beni. Our Chatarona birds are, however, typical *leucophrys*.

Myrmoborus myotherinus myotherinus (Spix)

8 ♂, 4 ♀; Palmar, Santa Ana, Todos Santos, Teoponte.

Owing to lack of adequate comparative material we follow Zimmer and refer the above specimens to the nominate race (see Zimmer, Amer. Mus. Novit., no. 545, 1932, p. 7).

Hypocnemis cantator ochrogyna Zimmer

Amer. Mus. Novit., no. 538, 1932, p. 14 (Tapirapoan, Matto Grosso, Brazil).

Apparently occurs in northern Bolivia ("Yuracares",—d'Orbigny).

Hypocnemis cantator collinsi Cherrie

8 ♂, 4 ♀; Chifñiri, Todos Santos.

Hypocnemoides maculicauda (Pelzeln)

8 ♂, 7 ♀; Mouth of the Rio Chapare, Todos Santos.

Myrmochanes hemileucus (Sclater and Salvin)

Recorded from Reyes, northern Bolivia.

Myrmeciza hyperythra (Sclater)

♀; Chatarona.

Myrmeciza atrothorax melanura (Ménétrières)

Myrmeciza atrothorax griseiventris Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 323 (Chatarona, Dept. Beni, Bolivia).

13 ♂, 11 ♀, 2 o; Chatarona, Susi, Chifñiri, mouth of the Rio Chapare, Todos Santos, Buenavista.

We fail to recognize *M. a. griseiventris* Carriker as distinct. The type and a topotype (♀) and a female from Chifñiri do not differ from specimens from Cochabamba and Santa Cruz.

Myrmeciza hemimelaena hemimelaena Sclater

17 ♂, 5 ♀; Susi, Chifñiri, Huanay, Palmar, Santa Ana, Todos Santos, Teoponte.

Formicarius analis analis (Lafresnaye and d'Orbigny)

11 ♂, 6 ♀; Chatarona, Susi, Huanay, mouth of the Rio Chapare, Santa Ana, Todos Santos, Teoponte.

Chamaeza brevicauda boliviana Hellmayr and Seilern

8 ♂, ♀; Sandillani, Palmar, San Jacinto, Samaipata.

These specimens show much variation in color. Perhaps the Santa Cruz birds might be said to be less heavily marked with black on the under parts.

Chamaeza mollissima yungae Carriker

Proc. Acad. Nat. Sci. Phila., 87, 1935, pp. 324-325 (Sandillani, Dept. La Paz, Bolivia).

2 ♂ ; Sandillani, Incachaca.

The Incachaca male of this interesting form agrees with the type from Sandillani.

Gymnopathys salvini salvini (Berlepsch)

Recorded from the Rio San Mateo, Yungas of Cochabamba, the type locality, and also from Todos Santos and from Rio Chimoré by Zimmer.

Hylophylax naevia inexpectata Carriker

Proc. Acad. Nat. Sci. Phila., 84, 1932, p. 6 (La Pampa, Sandia, Peru).

17 ♂ , 5 ♀ ; Chiniñiri, Santa Ana, Todos Santos.

This race is very close to *H. n. theresae* (des Murs) from which it differs merely in having the pileum a trifle more olivaceous. A male in juvenal plumage, collected August 7, has the downy lower parts and crown ashy and the mantle dull olivaceous. The wings are as in the adult.

Phlegopsis nigro-maculata nigro-maculata (Lafresnaye and d'Orbigny)

6 ♂ , 2 ♀ ; Chatarona, mouth of the Rio Chapare, Todos Santos.

Grallaricula flavirostris boliviana Chapman

2 ♂ , ♀ ; Sandillani, Incachaca.

Grallaria squamigera canicauda Chapman

Amer. Mus. Novit., no. 231, 1926, p. 1 (Cocopunco 10,000 ft., Prov. Larecaja, Bolivia).

2 ♂ , ♀ ; Hichuloma, Incachaca.

Grallaria erythrotis Sclater and Salvin

8 ♂ , 7 ♀ ; Sandillani, Incachaca.

Grallaria albigula Chapman

2 ♂ ; Samaipata.

A very rare species, previously known only from the type locality in Peru. Our Bolivian birds are remarkable in being virtually identical in color with four Peruvian skins in the Academy's collection. They differ only in being a trifle larger. Wings of Bolivian specimens measure 106 and 107 mm., those of our two Peruvian males 101.5 and 103 mm.

Grallaria rufula cochabambae Bond and de Schauensee

Not. Naturae, no. 44, April 5, 1940, p. 3 (Incachaca, 10,000 ft., Dept. Cochabamba Bolivia).

♂ , ♀ ; Incachaca.

Grallaria berlepschi berlepschi Hellmayr

♂ ; Todos Santos.

This specimen is slightly darker, more olive above and much less rufous on the throat and chest than a female from Maica, Brazil, which is some-

what intermediate between *G. b. berlepschi* and *G. b. yessupi* Carriker from Puerto Yessup, Dept. Junin, Peru. This species has not hitherto been recorded from Bolivia.

Grallaria auricularis Gyldenstolpe

Arkiv för Zool., 33 B, no. 13, 1941, p. 7 (Victoria, confluence of Rio Madre de Dios and Rio Beni, Bolivia).

The description indicates close relationship with *G. macularia*.

Family **FURNARIIDAE** (Oven-birds)

Geositta cunicularia titicacae Zimmer

Amer. Mus. Novit., no. 819, 1935, p. 1 (Tirapata, Titicaca basin, Peru).

14 ♂, 11 ♀; Callipampa, Cataví, La Cumbre.

Geositta punensis Dabbene

18 ♂, 24 ♀; Chocaya, Kari-Kari Mts., Llica, Pulacayo, Potosí, Uyuni.

Geositta rufipennis fasciata (Philippi and Landbeck)

6 ♂, 17 ♀; Calacoto, Tiraque, Tutimayo, Cataví, Chocaya, Finca Salo, Llagagua, Oploca, Potosí.

E. Reed (Anal. Univ. Chile, 93, 1896, p. 202) according to Hellmayr was undoubtedly in error when he recorded *Geositta isabellina* as a winter visitor to Bolivia and probably referred to *G. r. fasciata* (Hellmayr, The Birds of Chile, 1932, foot-note 1, p. 157).

Geositta tenuirostris (Lafresnaye)

8 ♂, 10 ♀; Incachaca, Tiraque, Callipampa, Cataví, Llagagua, Oploca, Uncia, Padilla, La Cumbre.

Furnarius rufus commersoni Pelzelin

17 ♂, 7 ♀; Chatarona, Ele-Ele, Tiraque, Tutimayo, Lagunillas, Samaipata, Tomina, Entre Rios, Villa Montes.

We have referred all our birds to *commersoni*. Tarija specimens, including a topotype of *schuhmacheri* Laubmann (Verh. Orn. Ges., Bayern, 20, pt. 1, 1933, p. 160) are all worn, with one exception, and display much variation. Some are indistinguishable from north Bolivian specimens. Birds from south Bolivia have been recorded as *paraguayae* Cherrie and Reichenberger (El Hornero, 1938, p. 103), but our Paraguayan examples have the under parts duller, with a grayish cast. We feel our material is inadequate to judge whether or not Laubmann's form should be recognized.

Furnarius leucopus assimilis Cabanis and Heine

Recorded from southeastern Bolivia (Puerto Suarez, Rio Paraguay).

Furnarius leucopus tricolor Giebel

♂, 2 ♀; Chatarona, mouth of the Rio Chapare.

Our specimens are obviously referable to this race rather than to *F. torridus* Selater and Salvin. Hellmayr (Cat. Bds. Amer., 13, pt. 4, 1925, p. 21) has recorded the latter from northern and eastern Bolivia, but in view of Zimmer's recent studies (Amer. Mus. Novit., no. 860, 1936, pp. 4-6) probably in error.

Coryphistera alaudina alaudina Burmeister

Recorded by Laubmann from Fortín Estero, Dept. Tarija.

Coryphistera alaudina campicola Todd

Known from eastern Bolivia, Prov. of Cordillera (Guanacos, Yuay), Dept. Santa Cruz, and from Quepo, Dept. Chuquisaca.

Cinclodes fuscus albiventris (Philippi and Landbeck)

8♂, 11♀, 0; Hichuloma, Tanapaca, Cerro del Juno, Incachaca, Callipampa, Cataví, Kari-Kari Mts., El Pongo.

Hellmayr (Birds of Chile, 1932, p. 185) has shown that *C. f. tucumanus* Chapman, of northwestern Argentina, is synonymous with *albiventris*.

Cinclodes atacamensis atacamensis (Philippi)

7♂, 9♀; Calacoto, Viloca, Tiraque, Tutimayo, Callipampa, Finca Salo, Llallagua, Oploca.

Upucerthia dumetaria hypoleuca Reichenbach

11♂, 6♀; Callipampa, Llica, Oploca, Uyuni, Cerdas.

Summer birds (January and February) are much more heavily squamated on the under parts than those taken in June and July. New to Bolivia. This is *darwini* Scott of Hellmayr's "Birds of the Americas."

Upucerthia validirostris pallida Taczanowski

17♂, 10♀; Tanapacá, Viloca, Cerro del Juno, Tiraque, Callipampa, Cataví, Cerdas, Chocaya, Kari-Kari Mts., Llallagua.

U. albigula Hellmayr, known only from the Province of Tacna, Chile, may be expected to occur in the neighboring section of Bolivia according to Hellmayr (Birds of Chile, 1932, p. 170).

Upucerthia andaecola Lafresnaye and d'Orbigny

19♂, 24♀, 0; Calacoto, Tanapacá, Tiraque, Tutimayo, Cataví, Llallagua, Oploca, Padilla.

Southern birds average larger than those from La Paz. Specimens in fresh plumage are much more buffy on the under parts. A nest found at Potosí, January 25, 1938, was placed at the end of a hole in a bank. It is composed of grass, lined with feathers. One of the white eggs measures 26×19.3 mm.

Upucerthia ruficauda (Meyen)

18♂, 9♀; Callipampa, Cataví, Chocaya, Llallagua, Potosí, Uyuni, Pulacayo.

Upucerthia harterti Berlepsch

10 ♂, 6 ♀; Tomina, Padilla, Samaipata, Ele-Ele.

The specimens of this rare species, hitherto known from but two females, have the following measurements: wing, ♂ 67-69.5, ♀ 65-67; bill, ♂ 22-23.5 mm. A female taken at Tomina, December 24, was laying. A male from Ele-Ele, taken October 15, and one from Padilla, taken January 1, had enlarged testes.

Phleocryptes melanops melanops (Vieillot)

♀ ?; Buenavista.

This bird is obviously referable to the nominate form, being very different from the larger and darker *schoenobaenus* which inhabits the mountains of Bolivia. It has not previously been recorded from Bolivia.

Phleocryptes melanops schoenobaenus Cabanis and Heine

3 ♂, ♀; Callipampa.

Leptasthenura aegithaloides berlepschi Hartert

25 ♂, 16 ♀, o; Calacoto, Callipampa, Catavi, Chocaya, Llallagua, Llica, Oploca, Potosí, Uyuni.

Leptasthenura andicola peruviana Chapman

Leptasthenura andicola boliviana Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 325 (km. 34, Yungas Railroad, Dept. La Paz, Bolivia).

♀; km. 34, Yungas Railroad (east of La Cumbre).

We have compared this bird, which is the type of *L. a. boliviana* Carriker, with a female of *peruviana* from Yanac, Dept. Ancash, and find that the two agree in every detail.

Leptasthenura fuliginiceps fuliginiceps (Lafresnaye and d'Orbigny)

13 ♂, 14 ♀; Tanapacá, Tiraque, Oploca, Padilla, Tomina, La Merced, San Lorenzo.

Leptasthenura yanacensis Carriker

Proc. Acad. Nat. Sci. Phila., 85, 1933, p. 9 (Yanac, Dept. of Ancash, Peru).

9 ♂, 6 ♀; Tanapacá, Viloca, Colomi, Tiraque.

This very distinct species appears to be related to *L. fuliginiceps* with which, however, it occurs side by side. It differs by having the upper parts uniformly rufous, the crown not sharply defined from the back, although the forehead is rufous. The sides of the head and under parts are rich ochraceous-buff instead of dull grayish buff. It further differs in having a decidedly longer and straighter bill, and the wing averages shorter.

Compared with the type from Yanac, Dept. Ancash, Peru, Bolivian specimens appear somewhat paler, particularly above, and will probably prove to represent an undescribed race when sufficient material from Peru is available for comparison.

Measurements of Bolivian specimens: ♂, wing 59.5, 60.5, 61 (3), 61.5, 62, 64; bill 10.5 (4), 11.5 (3); ♀, wing 57.5, 58.5, 60 (2), 61, 62; bill 9.5, 10, 10.5 (2), 11 mm. The type (♀) and only known specimen from Peru has a wing of 61.5, bill 9.75 mm. Tails of fully adult birds measure 94.5–99 mm. Five adult males of *fuliginiceps* have wings of 63.5–67, bills of 8.5–9; five females have wings of 60–63, bills of 8–8.5 mm.

Schizoeaca harterti Berlepsch

7 ♀, 8 ♀; Hichuloma, Incachaca.

Schoeniophylax phryganophila (Vieillot)

♀; Chatarona.

Synallaxis superciliosa samaipatae Bond and de Schauensee

Not. Naturae, no. 93, 1941, p. 4 (Samaipata, Dept. Santa Cruz, Bolivia).

10 ♂, 2 ♀, 0; Samaipata, Padilla, Rio Azero, Entre Rios.

A nest of this species, that contained three fresh eggs, was collected January 9, near Padilla. The female was flushed and "observed closely" but was not taken. The nest was situated about ten feet above the ground in a small tree that was growing in a deep and narrow ravine. It is described as the usual structure of twigs, characteristic of the genus *Synallaxis*, with almost no lining to the nest cavity. The eggs are dull greenish white in color. They measure 19.6×14.3 , 19.4×14.2 , 19.4×13.9 mm.

Synallaxis azarae azarae d'Orbigny

3 ♂, 3 ♀; San Cristobal, Incachaca.

Synallaxis azarae carabayae Zimmer

Amer. Mus. Novit., no. 819, 1935, p. 3 (Santo Domingo, southeast Peru).

6 ♂, 5 ♀; Calabatea, Hichuloma, Sandillani.

Synallaxis frontalis fuscipennis Berlepsch

22 ♂, 6 ♀, 3 0; Ele-Ele, mouth of the Rio Chapare, Samaipata, Tomina, Bermejo, Entre Rios, Fortín Campero, La Merced, San Lorenzo, Villa Montes.

We refer all our birds to *fuscipennis*, although the nominate form is said to inhabit eastern Santa Cruz and Tarija (Laubmann, Wiss. Ergeb. Deut. Gran Chaco-Exped., Vogel, 1930, p. 185). Our birds from the Province of Tarija do, however, average browner above, thereby approaching *S. f. frontalis*.

Synallaxis cabanisi fulviventris Chapman

10 ♂, ♀; Palmar, Todos Santos.

Synallaxis albescens australis Zimmer

Amer. Mus. Novit., no. 819, 1935, p. 2 (Puerto Pinasco, Paraguay).

6 ♂, 3 ♀; Chatarona, Ele-Ele, mouth of the Rio Chapare, Todos Santos, Rio Lipeo.

***Synallaxis gujanensis certhiola* Todd**

4 ♂, 2 ♀; Susi, Chifñiri, mouth of the Rio Chapare.

***Synallaxis scutata whitii* Sclater**

13 ♂, 8 ♀; Samaipata, Bermejo, Fortín Campero, Rio Azero, Rio Lipeo, Villa Montes.

***Synallaxis rutilans tertia* Hellmayr**

3 ♂, 4 ♀; Huanay, Santa Ana, Teoponte.

New to Bolivia. Compared with an example from the Rio Teodoro, Brazil, our Bolivian specimens are a trifle darker and more richly colored.

S. spixi and *S. subpudica* have been recorded by Sharpe from Bolivia (Cat. Bds. Brit. Mus., 15, 1890, pp. 43, 45), based on specimens taken by Bridges. Both these records are highly doubtful.

***Certhiaxis cinnamomea russeola* (Vieillot)**

3 ♂, 3 ♀; Chatarona, Todos Santos.

Compared with specimens from Argentina, Paraguay, and Brazil with which they agree.

***Cranioleuca albiceps albiceps* (Lafresnaye and d'Orbigny)**

3 ♂, 3 ♀; Hichuloma.

***Cranioleuca albiceps discolor* Zimmer**

Amer. Mus. Novit., no. 819, 1935, pp. 5-6 (Incachaca, Dept. Cochabamba, Bolivia).

5 ♂, ♀; Incachaca, San Cristobal.

***Cranioleuca vulpina foxi* Bond and de Schauensee**

Not. Naturae, no. 44, 1940, pp. 3-4 (Mouth of the Rio Chapare, Dept. Cochabamba, Bolivia).

2 ♂, 3 ♀; Mouth of the Rio Chapare.

These are the first Bolivian specimens of this species.

***Cranioleuca pyrrhophia pyrrhophia* (Vieillot)**

8 ♂, 7 ♀; Entre Rios, La Merced, Rio Lipeo, San Lorenzo, Villa Montes.

***Cranioleuca pyrrhophia striaticeps* (Lafresnaye and d'Orbigny)**

10 ♂, 9 ♀; Ele-Ele, Samaipata, Padilla, Tomina.

***Cranioleuca pyrrhophia rufipennis* (Sclater and Salvin)**

Known only from type locality—Tilotilo (La Paz).

***Cranioleuca gutturata gutturata* (Lafresnaye and d'Orbigny)**

♂, 4 ♀; Chifñiri, mouth of the Rio Chapare, Todos Santos.

Carriker claims a Peruvian race, *peruviana* (Cory), is recognizable (Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 352).

Asthenes pyrrholeuca affinis (Berlepsch)

♂, ♀; Fortín Campero, San Lorenzo.

New to Bolivia.

Asthenes heterura (Berlepsch)

8♂, 3♀; Tanapaca, Viloca, Chorros, Colomi, Tiraque.

Adults are readily distinguishable from *A. pudibunda* (Selater) of Peru by the narrower, more pointed rectrices. Immature birds do not show this character.

Asthenes modesta modesta (Eyton)

29♂, 23♀, 0; Callipampa, Cataví, Chocaya, Llallagua, Llica, Oploca, Potosí, Pulacayo, Uyuni.

Asthenes modesta rostrata (Berlepsch)

10♂, 3♀; Cerro del Juno.

Fresh Peruvian specimens are more buffy below than the above series, all of which are in worn plumage.

Asthenes humilis robusta (Berlepsch)

9♂, 11♀; La Cumbre and El Pongo, km. 34 Yungas Railroad, Viloca.

Asthenes d'orbignyi d'orbignyi (Reichenbach)

13♂, 21♀, 0; Tiraque, Tutimayo, "Cochabamba," Cataví, Llallagua, Llica, Oploca, Padilla, La Merced, San Lorenzo.

The Potosí specimens are intermediates (*d'orbignyi* × *arequipae*).

Asthenes d'orbignyi consobrina Hellmayr

9♂, 12♀; Calacoto, Tanapacá.

Five of our specimens of *consobrina* show no trace of the cinnamon gular spot, although others from the same localities have this well marked.

Asthenes d'orbignyi arequipae (Selater and Salvin)

4♂, 4♀; Callipampa.

Asthenes berlepschi (Hellmayr)

Known only from Chicani on the north slope of the Cordillera Real, Dept. La Paz. This bird, of which we have no specimens, will probably prove conspecific with *A. d'orbignyi*.

Asthenes punensis punensis (Berlepsch and Stolzmann)

♀; Tanapacá.

Asthenes punensis cuchacanchae (Chapman)

8♂, 4♀; Cerro del Juno, Tiraque, Oploca.

Not previously recorded from as far south as Potosí.

***Asthenes flammulata maculicauda* (Berlepsch)**

4 ♂, 2 ♀; Hichuloma, Incachaca.

This bird is obviously the southernmost representative of *flammulata*.

***Asthenes urubambensis urubambensis* (Chapman)**

4 ♂, 2 ♀; Hichuloma, km. 50 Yungas Railroad.

Apparently new to Bolivia. Compared with Urubamba specimens, with which our birds agree perfectly.

***Thripophaga fusciceps fusciceps* Sclater**

♂, 3 ♀; mouth of the Rio Chapare.

See Not. Naturae, no. 94, 1941, pp. 1-2.

***Phacellodomus rufifrons sincipitalis* Cabanis**

8 ♂, 7 ♀; Lagunillas, Fortín Campero, Villa Montes.

***Phacellodomus rufifrons peruvianus* Hellmayr**

5 ♂, ♀; Chatarona.

These birds average a trifle more grayish below and have the vent and flanks very slightly more olive than topotypes from Peru, but we do not consider that these differences warrant description of a new race. These specimens greatly extend the range of *peruvianus*, known previously only from northern Peru.

***Phacellodomus striaticeps striaticeps* (Lafresnaye and d'Orbigny)**

27 ♂, 16 ♀; Calacoto, Tanapacá, Viloca, Ele-Ele, Tiraque, Callipampa, Catavi, Llallagua, Oploca, Potosí, Padilla, Tomina.

***Phacellodomus ruber* (Vieillot)**

3 ♂, 2 ♀; Chatarona.

***Phacellodomus striaticollis maculipectus* Cabanis**

14 ♂, 12 ♀; Samaipata, Padilla, Tomina, La Merced.

***Margarornis squamigera squamigera* (Lafresnaye and d'Orbigny)**

11 ♂, 8 ♀; Chorros, Hichuloma, Incachaca, Palmar, San Cristobal, San Jacinto.

***Premnoplex brunescens stictonotus* (Berlepsch)**

♂, 2 ♀; Sandillani, Palmar, San Jacinto.

***Pseudocolaptes boissonneautii carabayae* Zimmer**

Amer. Mus. Novit., no. 862, 1936, p. 8 (Limbani, southeast Peru).

2 ♂, 6 ♀, 2 o; Chorros, Incachaca, San Cristobal, San Jacinto.

Not previously recorded from the Yungas of Cochabamba, although known from the Yungas of La Paz. Cochabamba birds tend to have the crown blacker than 5 birds from Carabaya, Peru. If the species exists in Santa Cruz it will probably be separable from *carabayae* with Cochabamba birds intermediate.

***Pseudoseisura cristata unirufa* (Lafresnaye and d'Orbigny)**

Known from eastern Bolivia (Llanos of Mojos, Trinidad). We have only extralimital specimens of this bird.

***Syndactyla rufosuperciliata oleaginea* (Sclater)**

20 ♂, 10 ♀; Lagunillas, Samaipata, Rio Azero, 25 km. east of Padilla, Bermejo, Entre Rios, Rio Lipeco.

***Syndactyla rufosuperciliata cabanisi* (Taczanowski)**

♂ imm.; Sandillani.

***Anabacerthia striaticollis yungae* (Chapman)**

6 ♂, 4 ♀; Calabatea, Sandillani, San Jacinto.

***Philydor erythrocercus ochrogaster* Hellmayr**

9 ♂, 5 ♀; Calabatea, Palmar, Santa Ana.

***Philydor rufus bolivianus* Berlepsch**

2 ♀; Calabatea, Santa Ana.

***Philydor ruficaudatus ruficaudatus* (Lafresnaye and d'Orbigny)**

2 ♂; Santa Ana.

***Automolus ochrolaemus ochrolaemus* (Tschudi)**

15 ♂, 11 ♀; Chiniñiri, Huanay, Palmar, Santa Ana, Teoponte.

***Automolus rufipileatus consobrinus* (Sclater)**

4 ♂, 6 ♀; Chiniñiri, Todos Santos.

The above birds agree well with a good series from Peru (Saposa, Puerto Yessup, Moyobamba).

***Simoxenops striatus* (Carraker)**

Anachilus striatus Carraker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 327 (Santa Ana, Dept. La Paz, Bolivia).

2 ♂, 2 ♀; Palmar, Santa Ana.

This species is at once distinguished from *S. ucayalae* Chapman, by its streaked upper surface, much smaller size, especially bill and feet. It may prove to be conspecific, but until intermediates are found it is best regarded as a distinct species.

***Thripadectes holostictus moderatus* Zimmer**

Amer. Mus. Novit., no. 819, 1935, p. 7 (Nequejahuiria, Rio Unduavi, Bolivia).

2 ♂, 3 ♀; Sandillani, Incachaca.

***Xenops minutus obsoletus* Zimmer**

5 ♂, 5 ♀; Chiniñiri, Huanay, Palmar, Santa Ana, Todos Santos, Teoponte.

***Xenops rutilans connectens* Chapman**

11 ♂, 7 ♀; Calabatea, mouth of the Rio Chapare, Santa Ana, Rio Azero, Entre Rios, Rio Lipeco, Villa Montes.

Sclerurus albicularis albicollis Carriker

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 326 (Teoponte, Dept. La Paz, Bolivia).

2 ♂ ; Santa Ana, Teoponte.

At once distinguishable from *zamorae* by its rufescent upper parts.

Sclerurus mexicanus peruvianus Chubb

♂ ; Todos Santos.

Previously recorded by Zimmer from the Rio San Antonio (Amer. Mus. Novit., no. 757, 1934, p. 18).

Lochmias nematura obscurata Cabanis

2 ♂ , 4 ♀ ; Sandillani, Samaipata, Rio Azero.

Family **DENDROCOLAPTIDAE** (Wood-hewers)**Dendrocolaptes certhia polyzonus** Todd

♂ , 3 ♀ ; Santa Ana.

Dendrocolaptes picumnus pallescens Pelzel

2 ♂ , 3 ♀ , 0 ; Rio Azero, Villa Montes.

Dendrocolaptes picumnus olivaceus Zimmer

Amer. Mus. Novit., no. 753, 1934, pp. 5-7 (Incachaca, Dept. Cochabamba, Bolivia).

Dendrocolaptes picumnus australis Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 329 (Santa Ana, Dept. La Paz, Bolivia).

4 ♂ , 4 ♀ ; Calabatea, mouth of the Rio Chapare, Samaipata.

A distinct race, connecting *picumnus* and *pallescens*. *D. p. olivaceus* is intermediate in every respect between *D. p. validus* and *pallescens*, making the latter a subspecies of *picumnus*. Zimmer's name has priority over Carriker's *australis*.

Dendrexetastes rufigula devillei (Lafresnaye)

♀ ; Todos Santos.

Previously recorded from the same locality by Zimmer (Amer. Mus. Novit., no. 728, 1934, p. 3).

Xiphocolaptes promeropirhynchus lineatocephalus (Gray)

7 ♂ , ♀ , 2 0 ; Sandillani, Incachaca, Samaipata, San Cristobal.

Xiphocolaptes orenocensis obsoletus Todd

3 ♂ , 2 ♀ ; Palmar, Santa Ana, Teoponte.

A single male from Palmar is decidedly darker than any of the others in this series.

Xiphocolaptes major castaneus Ridgway

7 ♂ , 7 ♀ ; Chiniñiri, Ele-Ele, Entre Rios, Fortin Campero, Rio Lipeo, Villa Montes.

A male from Chiniñiri has the pileum and the hind neck very pale.

***Dendroplex picus peruvianus* Zimmer**

Amer. Mus. Novit., no. 753, 1934, p. 14 (Santa Rosa, Upper Ucayali, Peru).

♂, 4 ♀; Chatarona, mouth of the Rio Chapare, Buenavista.

We have compared these specimens with a series of this race from Peru and consider them indistinguishable, except that the bills of Bolivian birds are somewhat shorter as pointed out by Zimmer. They are decidedly more rufescent than a series of *D. p. kienerii* (des Murs) from Teffé, Brazil, and the throat is more buffy.

***Xiphorhynchus guttatus d'orbignyianus* (Lafresnaye)**

10 ♂, 14 ♀; Huanay, mouth of the Rio Chapare, Santa Ana, Todos Santos, Teoponte, Rio Mapiri.

***Xiphorhynchus triangularis bangsi* Chapman**

7 ♂, 2 ♀; Sandillani, San Jacinto, Samaipata.

***Xiphorhynchus ocellatus brevirostris* Zimmer**

Amer. Mus. Novit., no. 756, 1934, pp. 18-20 (Rio Inambari, southeast Peru).

12 ♂, 9 ♀, 0; Calabatea, Palmar, Santa Ana, Todos Santos.

***Xiphorhynchus spixii juruanus* (Lesson)**

Xiphorhynchus obsoletus parvimaculatus Carriker, Proc. Acad. Nat. Sci. Phila., 86, 1934, p. 323 (Huacamayo, Peru).

♂, ♀, ♀ immat.; Chiniñiri.

Carriker compared these three specimens with a series of *X. s. juruanus* (Ihering) from the Rio Purus (identified by Hellmayr as such) and found the Chiniñiri birds indistinguishable (Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 353).

***Lepidocolaptes lacrymiger bolivianus* (Chapman)**

16 ♂, 11 ♀, 0; Sandillani, Incachaca, San Cristobal, San Jacinto, Samaipata.

Birds from Santa Cruz are a trifle duller than topotypes from Incachaca, but do not seem worthy of description as a new subspecies.

***Lepidocolaptes albolineatus fuscicapillus* (Pelzeln)**

♂, 2 ♀; Santa Ana, Chiniñiri.

***Lepidocolaptes angustirostris angustirostris* (Vieillot)**

14 ♂, 5 ♀; Lagunillas, Bermejo, Entre Rios, La Merced, Rio Lipeo, San Lorenzo, Villa Montes.

Southern Tarija birds belong to the nominate race. Among them there is a good deal of variation as to the color of the back. We have included under this race a bird from Lagunillas in southwestern Santa Cruz and in the light of our material we do not see how *L. a. certhiolus* (Todd) can be upheld, for some specimens from southern Tarija have paler backs than the Lagunillas bird.

***Lepidocolaptes angustirostris hellmayri* Naumburg**

6 ♂, 2 ♀, 0; Ele-Ele, Samaipata.

***Lepidocolaptes angustirostris bivittatus* (Lichtenstein)**

♂, ♀; Buenavista.

The streaks on the breast of this form are almost obsolete, but apparent when examined closely. The under parts are strongly tinged with buff.

***Lepidocolaptes angustirostris immaculatus* Carriker**

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 328 (Chatarona, Dept. Beni, Bolivia).

2 ♂, 4 ♀; Chatarona.

This race differs from any other form by completely lacking the streaks on the under surface which is dirty white with no buffy tinge.

***Campylorhamphus trochilirostris devius* Zimmer**

Amer. Mus. Novit., no. 728, 1934, pp. 5-6 (Todos Santos, Dept. Cochabamba, Bolivia).

3 ♂, 3 ♀; Chiniñiri, Palmar, Todos Santos.

***Campylorhamphus trochilirostris lafresnayanus* (d'Orbigny)**

There is one specimen of this form in the Academy's collection (Eyton Coll.) with no locality other than Bolivia.

***Glyphorhynchus spirurus albigularis* Chapman**

3 ♂, 2 ♀, 0; Palmar, Todos Santos.

***Sittasomus griseicapillus griseicapillus* (Vieillot)**

♂, 10 ♀; Bermejo, Entre Rios, Fortín Campero, Rio Lipeo, Villa Montes.

***Sittasomus griseicapillus viridis* Carriker**

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 327 (Santa Ana, Rio Coroico, 2200 ft., Dept. La Paz, Bolivia).

10 ♂, 7 ♀, 0; Chatarona, Calabatea, mouth of the Rio Chapare, Santa Ana, San Jacinto, Samaipata, Teoponte.

This recently described race resembles the nominate form, differing chiefly by having the upper parts darker and the lower back less strongly tinged with rufous. A single specimen from Chatarona, Dept. Beni, is intermediate between this form and *amazonus*. Hellmayr has recorded birds from "the sources of the Beni River" as *amazonus*.

***Deconychura longicauda pallida* Zimmer**

Field Mus. Nat. Hist. Pub., Zool. Ser., 17, pt. 1, 1929, p. 6 (Hyutanahan, Rio Purus, Brazil).

3 ♂, ♀; Chiniñiri, Santa Ana, Teoponte.

These birds agree with a specimen from Astillero, southeast Peru, which has been identified by Zimmer as this form (Amer. Mus. Novit., no. 757, 1934, p. 11).

Dendrocinclá fuliginosa atirostris (Lafresnaye and d'Orbigny)

5 ♂, 0; Mouth of the Rio Chapare, Santa Ana, Teoponte.

Dendrocinclá merula remota Todd

Known only from the Rio Yapacani, near Buenavista (the type locality) and from the Rio Surutú.

Family **TYRANNIDAE** (Tyrant Flycatchers)

Agriornis microptera microptera Gould

♀, 2 ♀; Bermejo, Fortin Campero.

This race has not previously been recorded from Bolivia.

Agriornis microptera andecola (d'Orbigny)

2 ♂, 3 ♀; Incachaca, Tiraque, Callipampa, Llica.

Agriornis montana montana (Lafresnaye and d'Orbigny)

11 ♂, 11 ♀; Tutimayo, Cataví, Llallagua, Llica, Oplaca, Uyuni, Chocaya, Padilla.

Agriornis montana intermedia Hellmayr

2 ♂, ♀; Viloca, km. 50 Yungas Railroad, El Pongo (Yungas Railroad).

Agriornis andicola albicauda (Philippi and Landbeck)

Recorded from western Bolivia,—Iquico, Illimani (Amer. Mus. Novit., no. 930, 1937, p. 2).

Xolmis cinerea (Vieillot)

Recorded from eastern Bolivia.

Xolmis velata (Lichtenstein)

♂; Chatarona.

This specimen was in breeding condition in late September.

Xolmis coronata (Vieillot)

Recorded from eastern and southern Bolivia (Santa Cruz de la Sierra and Villa Montes, Tarija).

Xolmis irupero irupero (Vieillot)

6 ♂, 6 ♀; Lagunillas, Entre Rios, Fortin Campero, Villa Montes.

Xolmis murina (Lafresnaye and d'Orbigny)

3 ♂, 13 ♀; Fortin Campero, San Lorenzo.

Muscisaxicola rufivertex occipitalis Ridgway

4 ♂, 10 ♀, 0; Calacoto, Viloca, Tiraque, Tutimayo, Cataví, Llallagua.

This race and *pallidiceps* appear to meet without intergradation near the northeastern end of Lake Poopó (Llallagua), but our specimens of the latter from this locality, taken May 7 and May 14, probably represent migrants

from farther south, since we have specimens of both the nominate form and *pallidiceps* from the Pampa de los Arrieros, Peru, taken in April. Bolivian birds (*occipitalis*) were in breeding condition in October (cf. Amer. Mus. Novit., no. 930, 1937, pp. 3-4).

***Muscisaxicola rufivertex pallidiceps* Hellmayr**

17 ♂, 12 ♀, 0; Callipampa, Chocaya, Llallagua, Oploca, Uyuni.

***Muscisaxicola albilora* Lafresnaye**

3 ♂, 2 ♀; Tanapacá, Colomi, Incachaca.

The above specimens were taken in April, June, and September.

***Muscisaxicola juninensis* Taczanowski**

Muscisaxicola tenuirostris Carriker, Proc. Acad. Nat. Sci. Phila., 83, 1931, p. 458 (1932) (Rock Forest, near Lake Junin, Peru).

13 ♂, 9 ♀, 0; Viloca, Chocaya, Kari Kari Mts., Llica, Pulacayo, Potosí, La Cumbre (Yungas Railroad).

Specimens taken in the Kari Kari Mts. (14,500-15,500 ft.) in January were breeding. Not previously recorded from Bolivia.

***Muscisaxicola flavinucha* Lafresnaye**

7 ♂, 8 ♀; Viloca, Cerro del Juno, Finca Salo, Llica, Potosí, Pulacayo, Uyuni.

***Muscisaxicola capistrata* (Burmeister)**

14 ♂, 4 ♀; Poopó, Catavi, Chocaya, Llallagua, Oploca, Uncia.

We fail to see how *M. c. borealis* Carriker (Proc. Acad. Nat. Sci. Phila., 83, 1931, p. 457 (1932), Puno, Peru) is tenable. In coloring it does not differ from birds taken in Bolivia or Argentina, nor is there any difference in size. All the above birds, including a series from Peru, were taken during April and May. The species breeds in Patagonia and Tierra del Fuego. The northern birds are obviously migrants.

***Muscisaxicola frontalis* (Burmeister)**

2 ♂, 2 ♀; Callipampa, Chocaya.

We also have a specimen taken in April at Pampa de los Arrieros, Peru. This species, which is evidently migratory, has not previously been recorded from either Peru or Bolivia. The Bolivian birds were secured in June.

***Muscisaxicola albifrons* (Tschudi)**

6 ♂, 5 ♀; Viloca, La Cumbre (Yungas Railroad).

***Muscisaxicola alpina grisea* Taczanowski**

10 ♂, 8 ♀; Viloca, Cerro del Juno, Incachaca, La Cumbre (Yungas Railroad), El Pongo (Yungas Railroad), Padilla.

Taken in January, March, June, October. A bird taken October 2, on the Cerro del Juno, was laying.

Muscisaxicola alpina cinerea Philippi and Landbeck

6 ♂, 5 ♀, 0; Viloca, Cerro del Juno, Chocaya, Finca Salo, Potosí, Padilla.

Not previously recorded from Bolivia. Taken during January, February, March, and in October. A bird was taken on the Cerro del Juno, October 2, where *grisea* was nesting at this time. No example of *cinerea* is labelled as breeding, although three full-grown but immature specimens were taken at Viloca, March 25 and 26.

Muscisaxicola maculirostris maculirostris Lafresnaye and d'Orbigny

20 ♂, 9 ♀; Tanapacá, Cochabamba, Incachaca, Tiraque, Tutimayo, Cataví, Chocaya, Llallagua, Llica, Uyuni, Oploca, San Lorenzo.

Muscisaxicola fluviatilis Sclater and Salvin

Muscisaxicola titicacae Carriker, Proc. Acad. Nat. Sci. Phila., 83, 1931, p. 459 (1932) (Desaguadero, Titicaca, Peru).

4 ♂, 3 ♀; Huanay, mouth of the Rio Chapare, Santa Ana, Todos Santos, Teoponte.

The type of *M. titicacae* is an immature example of *M. fluviatilis*.

Lessonia rufa rufa (Gmelin)

2 ♂, 4 ♀; Fortín Campero, San Lorenzo.

New to Bolivia.

Lessonia rufa oreas (Sclater and Salvin)

12 ♂, ♀; Llica.

Myiotheretes striaticollis pallidus Berlepsch

6 ♂, 6 ♀; Chorro, Incachaca, Samaipata, Bermejo, Rio Lipeo, San Lorenzo.

All Bolivian specimens, including those from the Yungas of La Paz, evidently belong to the southern race.

Cnemarchus erythropygius bolivianus Carriker

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 332 (La Cumbre, Yungas Railroad, Dept. La Paz, Bolivia).

♂, ♀; Hichuloma, La Cumbre (Yungas Railroad).

These specimens have less black on the distal portion of the tail than one bird from Pichincha, Ecuador, and one from Atué, Peru.

Cnemarchus rufipennis (Taczanowski)

5 ♂, 2 ♀; Finca Salo, Viloca, above Tutimayo.

Ochthodiaeta fuscorufa Sclater and Salvin

2 ♂, 4 ♀; Incachaca, San Cristobal.

Ochthoeca oenanthoides oenanthoides (Lefresnaye and d'Orbigny)

16 ♂, 17 ♀, 2 o; Calacoto, Viloca, Tiraque, Tutimayo, Callipampa, below Cataví, Chocaya, Llallagua, Llica, Oploca, Potosí, El Pongo (Yungas Railroad).

Ochthoeca fumicolor berlepschi Hellmayr

8 ♂, 9 ♀; Hichuloma, Incachaca.

Ochthoeca leucophrys leucophrys (Lafresnaye and d'Orbigny)

14 ♂, 3 ♀, 3 o; La Paz, Chorros, Incachaca, Tiraque, Finca Salo (Oploca), Padilla.

Not previously recorded from the Departments of Chuquisaca and Potosí. One adult female from Oploca (Dept. Potosí) agrees with the description of *tucumana* Berlepsch of western Argentina. Others from this locality are indistinguishable from birds from Cochabamba.

Ochthoeca rufi-pectoralis rufi-pectoralis (Lafresnaye and d'Orbigny)

7 ♂, 9 ♀, o; Hichuloma, Chorros, Incachaca.

Ochthoeca cinnamomeiventris thoracica Taczanowski

3 ♂, o; Sandillani, Incachaca.

Ochthoeca pulchella pulchella Sclater and Salvin

♀; Sandillani.

Ochthoeca albididema spodionota Berlepsch and Stolzmann

Ochthoeca jelskii boliviana Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 331 (Hichuloma, Dept. La Paz, Bolivia).

5 ♂, 3 ♀; Hichuloma, Incachaca, San Cristobal, Samaipata.

Compared with a single male of *spodionota* from Rumicruz, Dept. Junin, our birds are similar, except that the greater wing coverts are broadly tipped with rufous and the tertials conspicuously edged with rufous. The Peruvian bird may not, however, be fully adult. It is significant that in the original description of *spodionota*, Berlepsch and Stolzmann state that in regard to the rufous borders to the wing-coverts and tertials, *spodionota* resembles *jelskii*. Our Bolivian birds are exactly like *jelskii* in this respect.

Sayornis nigricans latirostris (Cabanis and Heine)

4 ♂, ♀, o; Santa Ana, Samaipata, Rio Azero, La Merced, Rio Lipeo.

Colonia colonus niveiceps Zimmer

Field Mus. Nat. Hist. Publ., Zool. Ser., 17, pt. 7, 1930, p. 368 (Pucatanbo, Peru).

♀; Todos Santos.

Gubernetes yetapa (Vieillot)

Gubernetes yetapa benii Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 332 (Chatarona, Dept. Beni, Bolivia).

♂, ♀; Chatarona.

On comparison with a male and female from Amambay and Horqueta, Paraguay, we see no difference distinguishing Bolivian birds. Carriker gives the narrow breast band as the best character of *benii*, but our male from Paraguay has this even narrower than has the type of *benii*.

Alectrurus tricolor (Vieillot)

Recorded from eastern Bolivia (Mojos, Guarayas).

Knipolegus aterrimus aterrimus Kaup

25 ♂, 11 ♀; Ele-Ele, mouth of the Rio Chapare, Todos Santos, Tutimayo, Samaipata, Oploca, Tomina, Entre Rios, Fortín Campero, La Merced, Rio Lipeo, San Lorenzo.

Knipolegus aterrimus anthracinus Heine

2 ♂, 5 ♀; Hichuloma, Sandillani.

Knipolegus cabanisi Schulz

13 ♂, 13 ♀; Samaipata, Padilla, Bermejo, Rio Lipeo, Tarija-Villa Montes road, km. 75.

Knipolegus poecilurus subsp.

Recorded from eastern Bolivia (Prov. del Sara). We have no specimens of this species from Bolivia.

A Bolivian bird in worn plumage "is exceedingly like the type of *venezuelanus*" and "assignment to *peruanus* is not justified" (Zimmer, Amer. Mus. Novitates, no. 962, p. 27, 1937).

Phaeotriccus hudsoni (Sclater)

Recorded from eastern Bolivia (Santa Cruz de la Sierra).

Entotriccus striaticeps (Lafresnaye and d'Orbigny)

♂, ♀; Bermejo, Fortín Campero.

Hymenops perspicillata perspicillata (Gmelin)

2 ♂, 5 ♀; Chatarona, Fortín Campero, Villa Montes.

The wing of the female from Chatarona measures 82.5 mm., those of females from farther south 78-83 mm.

Fluvicola pica albiventer (Spix)

2 ♂, 3 ♀, 0; Mouth of the Rio Chapare, Todos Santos, Chiquitos, Lagunillas, Villa Montes.

Arundinicola leucocephala (Linnaeus)

2 ♀; Chatarona.

We have a male from Iquitos, Peru, collected in April 1878, by H. Whitely.

Pyrocephalus rubinus rubinus (Boddaert)

9 ♂, 4 ♀; Chatarona, Susi, Chifñiri, mouth of the Rio Chapare, Todos Santos, Entre Rios, San Lorenzo.

The birds from northern Bolivia were taken in August, those from the south during July and October.

Ochthornis littoralis (Pelzel)

♂, 2 ♀, 0; Susi, Chiniiri, Huanay.

Satrapa icterophrys (Vieillot)

12 ♂, 4 ♀, 0; Chatarona, Cochabamba, Ele-Ele, Incachaca, Tomina, Bermejo, Entre Rios, La Merced, Rio Lipeo, San Lorenzo.

We follow Hellmayr in not recognizing *hellmayri* Chubb (but see Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 333).

Machetornis rixosa rixosa (Vieillot)

5 ♂, 5 ♀; Chatarona, Bermejo, Entre Rios, Fortín Campero, Villa Montes.

Muscivora tyrannus tyrannus (Linnaeus)

2 ♂, ♀; Chatarona, Fortín Campero.

One of the Chatarona specimens is immature and does not show all the characters of the race. These birds were taken in September.

Tyrannus tyrannus (Linnaeus)

3 ♂, ♀; Chatarona, Entre Rios.

Chatarona birds were taken from September 24 to 29, the specimen from Entre Rios, October 20.

Tyrannus melancholicus melancholicus Vieillot

8 ♂, 4 ♀; Huanay, Sandillani, Ele-Ele, Incachaca, Palmar, Samaipata, Entre Rios.

Taken virtually throughout the year.

Empidonomus varius varius (Vieillot)

7 ♂, 2 ♀, 0; Rio Surutú, Samaipata, Santa Cruz, Rio Azero, Entre Rios, Rio Lipeo.

Collected during October, November, and on March 22.

Empidonomus aurantio-atro-cristatus aurantio-atro-cristatus (Lafresnaye and d'Orbigny)

6 ♂, 14 ♀; Chatarona, Ele-Ele, Lagunillas, Tomina, Entre Rios, Villa Montes.

Taken from September to December.

Legatus leucophaeus leucophaeus (Vieillot)

3 ♂, ♀; Chatarona, Calabatea, Todos Santos.

Sirystes sibilator albocinereus Sclater and Salvin

2 ♂, Huanay, mouth of the Rio Chapare.

New to Bolivia. The wings of these birds measure 95 and 102 mm. That of a male from El Tingo, Peru, measures 94.5 mm., of a female from the same locality, 96.5 mm.

Myiodynastes luteiventris vicinior Cory

Recorded from the Rio Espiritu Santo and from the Province of Sara (Zimmer, Amer. Mus. Novit., no. 28, 1937, pp. 1-6).

Myiodynastes maculatus solitarius (Vieillot)

17 ♂, 6 ♀; Chatarona, Susi, Huanay, Ele-Ele, Todos Santos, Samaipata, Lagunillas, Rio Azero, Entre Rios, Villa Montes.

Taken from August 1 to November 27. The birds were in breeding condition from September until November.

Myiodynastes chrysocephalus chrysocephalus (Tschudi)

5 ♂, 4 ♀; Sandillani, Incachaca, Palmar, above the Rio Azero.

New to Bolivia. Our birds agree well with Peruvian specimens from Utubamba, Oconeque, Santo Domingo (Inca Mine).

Megarhynchus pitangua pitangua (Linnaeus)

3 ♂, 3 ♀; Chatarona, Susi, Todos Santos.

Myiozetetes cayanensis cayanensis (Linnaeus)

♂, 2 ♀; Chatarona.

Myiozetetes similis similis (Spix)

5 ♂, 3 ♀; Huanay, Chiniñiri, Santa Ana, Todos Santos.

Myiozetetes granadensis obscurior Todd

5 ♂, 5 ♀; Chiniñiri.

Pitangus sulphuratus maximilliani (Cabanis and Heine)

5 ♂, 5 ♀; Chatarona, Todos Santos, mouth of the Rio Chapare, Samaipata, Villa Montes, La Merced.

These birds were all taken between 600 and 5500 feet. Males have wings of 119-127, females 114-117 mm.

Pitangus sulphuratus bolivianus (Lafresnaye)

4 ♂, 4 ♀; Incachaca, Tutimayo, Oploca, Entre Rios, San Lorenzo.

These specimens, taken from 4600 to 11,000 feet, average decidedly paler below and are larger than those recorded under *maximilliani*. Males have wings of 129-132, females 121-131 mm.

Pitangus lictor lictor (Lichtenstein)

2 ♂, 3 ♀; Chatarona, mouth of the Rio Chapare.

Apparently not hitherto recorded from Bolivia.

Myiarchus tyrannulus tyrannulus (Müller)

7 ♂, 12 ♀; Chatarona, Huanay, Ele-Ele, Palmar, Santa Ana, Todos Santos, Rio Azero, Bermejo, Entre Rios, Rio Lipeo, Villa Montes.

According to Zimmer there are no "definite characters" separating *chlorepiscus* from the nominate form (Amer. Mus. Nov., no. 994, 1938, p. 2).

Myiarchus swainsoni pelzelni Berlepsch

Recorded from Trinidad, Rio Mamoré (Zimmer). We have no Bolivian specimens.

Myiarchus swainsoni ferocior Cabanis

8♂, 3♀, 0; Susi, Huanay, Todos Santos, Lagunillas, Villa Montes.

Myiarchus ferox australis Hellmayr

4♂, 5♀; Susi, Huanay, mouth of the Rio Chapare, Palmar, Buenavista, Tomina.

Myiarchus cephalotes gularis Zimmer

Amer. Mus. Novit., no. 994, 1938, p. 17 (Locotal, 5800 ft., Dept. Cochabamba, Bolivia).

3♂, 3♀; Calabatea.

Myiarchus tuberculifer tuberculifer (Lafresnaye and d'Orbigny)

6♂, 5♀; Mouth of the Rio Chapare, Palmar, Todos Santos, Santa Ana.

We refer all birds taken below 4000 feet to the nominate form. Wings of males measure 80-83.5 mm., of females 77-85 mm.

Myiarchus tuberculifer atriceps Cabanis

9♂, 7♀; Todos Santos, Samaipata, Padilla, Rio Azero, Tomina, Entre Rios.

The race inhabiting the Subtropical Zone. Wings of males measure 85.5-92.5, of females 82-86 mm.

Contopus richardsonii richardsonii (Swainson)

♀; Calabatea.

Taken November 19. Our Peruvian specimens of this migrant from North America were collected from October 12 to January 7.

Contopus cinereus pallescens (Hellmayr)

4♂, 9♀; Chiniñiri, Huanay, Santa Ana, Todos Santos, Lagunillas, Samaipata, Teoponte, Entre Rios, Villa Montes.

New to Bolivia.

Contopus fumigatus fumigatus (Lafresnaye and d'Orbigny)

6♂, 3♀; Sandillani, Incachaca, San Cristobal.

Contopus fumigatus brachyrhynchus Cabanis

2♀; Tomina, Bermejo.

Empidonax euleri euleri (Cabanis)

Recorded from Mission San Antonio, Rio Chimoré, in northern Cochabamba by Zimmer (Amer. Mus. Novit., no. 1042, 1939, p. 5).

Empidonax euleri bolivianus Allen

7♂, 2♀, 0; Todos Santos, mouth of the Rio Chapare, Susi, Santa Ana.

These specimens were taken between July 15 and September 10. Two males taken at Susi, September 10, are in juvenal plumage.

***Empidonax euleri argentinus* (Cabanis)**

9 ♂, 5 ♀; Villa Montes, Todos Santos, Samaipata, Rio Azero, Entre Rios, Ele-Ele, Lagunillas.

The bird from Todos Santos was taken August 7. Those from Samaipata, including one with testes enlarged (Nov. 27), were taken in November. Those from the other localities were taken during October and November.

***Cnemotriccus fuscatus bimaculatus* (Lafresnaye and d'Orbigny)**

4 ♂, 5 ♀; Villa Montes.

***Cnemotriccus fuscatus beniensis* Gyldenstolpe**

Arkiv för Zool., 33 B, no. 13, 1941, p. 5 (Victoria, confluence of Rio Madre de Dios and Rio Beni, Bolivia).

♂; Susi.

Our single specimen of this newly described race is not fully adult, and does not show the characters ascribed to it.

***Mitrephanes phaeocercus olivaceus* Berlepsch and Stolzmann**

Known from the Yungas of La Paz and Cochabamba.

***Terenotriccus erythrurus brunneifrons* Hellmayr**

6 ♂, ♀; Chifñiri, Santa Ana, Todos Santos, Teoponte.

***Myiobius villosus peruvianus* Todd**

Recorded from the Yungas of La Paz.

***Pyrhomyias cinnamomea cinnamomea* (Lafresnaye and d'Orbigny)**

15 ♂, 11 ♀, o; Calabatea, Sandillani, Incachaca, San Cristobal, Santa Ana, Samaipata, Tomina, "Yungas."

***Myiophobus ochraceiventris* (Cabanis)**

Recorded from western Bolivia (Yungas of La Paz).

***Myiophobus inornatus* Carriker**

Proc. Acad. Nat. Sci. Phila., 83, 1931, p. 461 (1932) (Santo Domingo, 6000 ft., Dept. Puno, Peru).

3 ♂; Sandillani, San Jacinto.

A distinct species, apparently rare both in Peru and Bolivia.

***Myiophobus fasciatus auriceps* (Gould)**

15 ♂, 15 ♀; Chatarona, Chifñiri, Huanay, Ele-Ele, Palmar, Santa Ana, Lagunillas, Samaipata, Padilla, Tomina, Entre Rios, Villa Montes.

A nest, containing two heavily incubated eggs, was found at Padilla, January 1, 1938. It is a small, compact cup composed of grass and leaves, lined with fine grass stems. Eggs cream color, spotted and speckled chiefly about the larger ends with chestnut and lilac.

***Hirundinea bellicosa pallidior* Hartert and Goodson**

5 ♂, 9 ♀; Ele-Ele, Tomina, Sandillani, Oploca.

***Onychorhynchus coronatus orbignyianus* Carriker**

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 333 (Santa Ana, Rio Coroico, Dept. La Paz, Bolivia).

♂, 3 ♀; Susi, Chiniñiri, Santa Ana.

Hellmayr's record of *O. c. castelnau* Deville from Yuracarés may be referable to this recently described race, which is slightly different from *castelnau*. In *orbignyianus* the chest is somewhat less barred and the tail slightly paler than in the more northern race.

***Platyrinchus mystaceus* subsp.**

♀; Palmar.

New to Bolivia. Differs from a female of *P. m. zamorae* (Chapman) in having the posterior under parts ochraceous-rufous, the middle of the belly in *zamorae* being a clear lemon-yellow.

***Platyrinchus senex* subsp.**

♂; Teoponte.

New to Bolivia. Resembles a specimen from Lagarto, eastern Peru.

***Platyrinchus coronatus coronatus* Slater**

Recorded from the falls of the Rio Madeira.

***Tolmomyias sulphurescens pallescens* (Hartert and Goodson)**

5 ♂, 6 ♀; Todos Santos, mouth of the Rio Chapare, Palmar, Chatarona, Calabatea.

***Tolmomyias sulphurescens australis* Bond and de Schauensee**

Not. Naturae, no. 93, 1941, p. 5 (Entre Rios, Dept. Tarija, Bolivia).

6 ♂, 5 ♀; Bermejo, Fortín Campero, Entre Rios, Rio Lipeo.

This recently described race resembles *pallescens* but is slightly larger.

***Tolmomyias assimilis calamae* Zimmer**

Amer. Mus. Novit., no. 1045, 1939, p. 12 (Calamá, Rio Madeira, Brazil).

3 ♂, 8 ♀; Santa Ana, Teoponte, Todos Santos, Chiniñiri, Calabatea, Huanay.

This and the foregoing species are easily confused. However, in series the present bird can be distinguished most readily by the much more pronounced wing markings and by its gray crown with but a faint admixture of green, instead of green with a slight admixture of gray. The upper parts are moreover less yellowish green. The speculum, given as the best distinguishing character by Zimmer, is more pronounced in *assimilis*, but cannot in itself be relied upon in identifying the two species.

***Tolmomyias flaviventris subsimilis* Carriker**

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 334 (Santa Ana, Rio Coroico, Dept. La Paz, Bolivia).

4 ♂, 2 ♀; Huanay, Santa Ana.

Rhynchocyclus olivaceus guianensis McConnell

2 ♂, 2 ♀; mouth of the Rio Chapare, Todos Santos.

Rhynchocyclus fulvipectus (Sclater)

Recorded by Chapman from Locotal (5,800 ft.), Bolivia (Bull. Amer. Mus. Nat. Hist., 55, 1926, p. 484).

Ramphotrigon megacephala boliviana Zimmer

Amer. Mus. Novit., no. 1045, 1939, p. 17 (Mission San Antonio, Rio Chimoré, Dept. Cochabamba, Bolivia).

♂; Chiniñiri.

Todirostrum chrysocrotaphum neglectum Carriker

Proc. Acad. Nat. Sci. Phila., 83, 1931, p. 460 (1932) (Huacamayo, Peru).

3 ♂, 2 ♀; Palmar, Santa Ana, Todos Santos.

Todirostrum cinereum intermedium Carriker

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 334 (Chatarona, Dept. Beni, Bolivia).

♂; Chatarona.

A poorly marked form known only from the type. More specimens are need to validate this race.

Todirostrum cinereum coloreum Ridgway

Recorded from eastern Bolivia (Mojos, Cabo Emma, Rio Paraguay).

Todirostrum latirostre mixtum Zimmer

Amer. Mus. Novit., no. 1066, 1940, p. 8 (Candamo, southeast Peru).

7 ♂, 2 ♀; Chiniñiri, Huanay, mouth of the Rio Chapare, Todos Santos, Teoponte.

Todirostrum plumbeiceps obscurum Zimmer

Amer. Mus. Novit., no. 1066, 1940, p. 10 (Santo Domingo, southeast Peru).

3 ♂, ♀; Sandillani, Teoponte.

These birds have been compared with topotypes from Peru, and are easily distinguishable from specimens from southern Bolivia.

Todirostrum plumbeiceps viridiceps (Salvadori)

5 ♂, 6 ♀; Bermejo, Rio Azero, Rio Lipeo, Villa Montes.

Euscarthmornis spodiops (Berlepsch)

6 ♂; Incachaca, Palmar.

Euscarthmornis rufigularis (Cabanis)

♂; Calabatea.

New to Bolivia. This example is similar to a male from San Juan, Chanchamayo, Peru. The Academy is fortunate in having in its collection two of the five known specimens of this rare species.

Euscarthmornis margaritaceiventer margaritaceiventer (Lafresnaye and d'Orbigny)
13 ♂, 6 ♀; Ele-Ele, Samaipata, Tomina, Bermejo, Entre Rios, Fortín Campero, La Merced, Villa Montes.

Euscarthmornis margaritaceiventer rufipes (Tschudi)
6 ♂; Huanay, Teoponte, Santa Ana.

These specimens agree with Peruvian examples.

Euscarthmornis zosterops griseipectus (Snethlage)
Idioptilon rothschildi albopectus Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 335
(Santa Ana, Rio Coroico, Dept. La Paz, Bolivia).

4 ♂, 2 ♀; Susi, Huanay, Santa Ana, Teoponte.

The nomenclature of this species and allied forms has been much confused. For an elucidation see Zimmer, Amer. Mus. Novit., no. 1066, 1940, pp. 13, 14.

Myiornis albiventris (Berlepsch and Stolzmann)
3 ♂, 2 ♀; Huanay, Palmar, Santa Ana, Teoponte.

A rare bird, previously known only from the type and two other specimens from central Peru.

Perissotriccus ecaudatus ecaudatus (Lafresnaye and d'Orbigny)
3 ♂, 2 ♀; Susi, mouth of the Rio Chapare, Santa Ana.

We do not agree with Zimmer in placing this species in the genus *Myiornis*.

Pseudotriccus simplex (Berlepsch)
♀; Sandillani.

Pseudotriccus ruficeps (Lafresnaye)

We have no specimen from Bolivia, whence the species has been recorded from Sandillani.

Hemitriccus flammulatus Berlepsch

13 ♂, 4 ♀; Chiniñiri, mouth of the Rio Chapare, Santa Ana, Todos Santos, Teoponte.

Pogonotriccus ottonis Berlepsch

3 ♂, 6 ♀; Calabatea, Palmar.

Pogonotriccus orbitalis (Cabanis)

♀; Palmar.

On account of its small size this bird may prove separable from birds from Peru and Ecuador. Four males from La Pampa, Huacamayo, and Moyobamba have wings of 52-55, tails 43-45 mm. A female from Huacamayo has a wing of 55, tail 45. The Palmar example has a wing of 48.5, tail 38.5. There is no perceptible color difference.

Phylloscartes ventralis angustirostris (Lafresnaye and d'Orbigny)

13 ♂, 12 ♀; Calabatea, Sandillani, San Jacinto, Lagunillas, Samaipata, Padilla, Rio Azero, Bermejo, Entre Rios, Rio Lipeo.

Capsiempis flaveola flaveola (Lichtenstein)

Recorded from eastern Bolivia (Guarayos).

Euscarthmus meloryphus meloryphus Wied

♂, 2 ♀; Chatarona, Villa Montes.

See Zimmer (Amer. Mus. Novit., no. 1095, 1940, p. 3) for a discussion of this form.

Pseudocolopteryx acutipennis (Sclater and Salvin)

14 ♂, 5 ♀; Calacoto, Tanapacá, Chorros, Incachaca, mouth of the Rio Chapare, Oploca, Padilla.

Habrura pectoralis pectoralis (Vieillot)

We have no specimens of this form which has been recorded from Chiquitos in eastern Bolivia.

Culicivora caudacuta (Vieillot)

We have no Bolivian specimens of this bird which has been recorded from Buenavista, Dept. Santa Cruz.

Tachuris rubrigastra alticola (Berlepsch and Stolzmann)

Tachurus (sic) *rubrigastra grandis* Carriker, Proc. Acad. Nat. Sci. Phila., 83, 1931, p. 463 (1932) Desaguadero, Lake Titicaca, Peru).

8 ♂, ♀; Callipampa.

New to Bolivia. These specimens, which agree well with a series from Titicaca, Peru, have wings of 55-60 mm. Berlepsch and Stolzmann give wing measurements of 54-57 mm. for Junin specimens. There is no constant color difference between Peruvian and Bolivian examples.

Anairetes parulus aequatorialis Berlepsch and Taczanowski

10 ♂, 4 ♀; Calacoto, Hichuloma, Chorros, Tiraque, Callipampa, Finca Salo.

Anairetes antedates *Spizitornis* of authors.

Anairetes flavirostris flavirostris Sclater and Salvin

13 ♂, 5 ♀, 3 o; Tiraque, Tutimayo, Samaipata, Callipampa, below Catavi, Oploca, Padilla, La Merced, San Lorenzo.

Yanacea alpina boliviana Carriker

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 336 (km. 50, Yungas Railroad, Dept. La Paz, Bolivia).

♀; km. 50, Yungas Railroad (13,500 ft.).

The type and only known specimen resembles closely a female of the nominate form from Yanac, Dept. Ancash, Peru, but the belly is less tinged

with sulphur, the crown is darker and the crest plumes are shorter. More material is required to validate this race.

Stigmatura budytoides budytoides (Lafresnaye and d'Orbigny)

9 ♂, 6 ♀, 0; Ele-Ele, Tomina.

We see no difference in the tail markings between this form and *inzonata* Wetmore and Peters, but the birds from Cochabamba are decidedly washed with buff below. One specimen from Tomina, Dept. Chuquisaca, resembles *inzonata*, but four others are like the nominate form.

Stigmatura budytoides inzonata Wetmore and Peters

3 ♂, 4 ♀; Lagunillas, Samaipata, Villa Montes.

Serpophaga subcristata (Vieillot)

2 ♂, 5 ♀; Todos Santos, Buenavista, Bermejo, Fortín Campero.

Serpophaga inornata Salvadori

5 ♂, 4 ♀, 0; Chatarona, Susi, Todos Santos, Fortín Campero, Villa Montes.

Serpophaga munda Berlepsch

21 ♂, 11 ♀; Ele-Ele, Samaipata, Oploca, Tomina, Bermejo, Entre Rios, Fortín Campero, La Merced, Rio Lipeo, San Lorenzo.

Serpophaga cinerea cinerea (Tschudi)

3 ♂, 3 ♀, 0; Incachaca, Palmar.

Ridgwayornis nigricans (Vieillot)

6 ♂, ♀; Entre Rios, Fortín Campero.

New to Bolivia. Birds were breeding at Entre Rios late in October.

The genus *Ridgwayornis* was created for this species by A. W. Bertoni. It antedates *Taczanowskia* Stolzmann, a name suggested for the same species.

Mecocerculus leucophrys leucophrys (Lafresnaye and d'Orbigny)

23 ♂, 14 ♀; Hichuloma, Chorro, Incachaca, Palmar, San Jacinto, Viloca, Samaipata, Tomina.

Mecocerculus stictopterus taeniopterus Cabanis

♂; San Cristobal.

Mecocerculus hellmayri Berlepsch

9 ♂, 6 ♀, 0; Incachaca, Palmar, San Cristobal, Samaipata, Padilla.

We also have a male from La Pampa, Sandia, Peru, from which Republic this species does not appear to have been recorded.

Elaenia flavogaster flavogaster Thunberg

4 ♂, 2 ♀, 0; Chatarona, Sandillani, Incachaca, Padilla, Tomina.

Elaenia spectabilis spectabilis Pelzeln

2 ♀; Chatarona, Lagunillas, Villa Montes.

Elaenia albiceps albiceps (Lafresnaye and d'Orbigny)

2 ♂, ♀; Sandillani, Buenavista.

The female, taken at Sandillani on November 23, is immature.

Elaenia albiceps chilensis Hellmayr

3 ♂, ♀; Huanay, Calabatea.

Taken in August and November.

Elaenia parvirostris Pelzeln

22 ♂, 8 ♀; Chatarona, Ele-Ele, Palmar, Lagunillas, Samaipata, Padilla, Tomina, Entre Rios, Villa Montes.

Apparently nesting near Tomina (Dept. Chuquisaca) in January. One male taken at Samaipata, November 16, had enlarged testes. This series was collected from July 26 to January 9.

Elaenia strepera Cabanis

15 ♂, 2 ♀; Samaipata, Rio Azero, Tomina.

New to Bolivia. Taken from November 2 to January 8. Males with enlarged testes were taken throughout this period.

Elaenia gigas Sclater

♀; Chiniñiri.

New to Bolivia. The individual taken was incubating (Sept. 4). The wing measures 88 mm.

Elaenia chiriquensis albivertex Pelzeln

3 ♂, 2 ♀; Chatarona, Santa Ana.

Elaenia obscura obscura (Lafresnaye and d'Orbigny)

12 ♂, 17 ♀; Sandillani, Incachaca, Palmar, Samaipata, Padilla, above Rio Azero (5300 ft.), Bermejo, Rio Lipeo, Tarija-Villa Montes road (7000 ft.).

Myiopagis gaimardii gaimardii (d'Orbigny)

7 ♂, 4 ♀, 0; Chiniñiri, Huanay, Santa Ana.

Myiopagis viridicata viridicata (Vieillot)

9 ♂, 3 ♀; Lagunillas, Rio Azero.

Myiopagis caniceps caniceps (Swainson)

♂; Rio Lipeo.

New to Bolivia.

Suiriri suiriri (Vieillot)

8 ♂, 8 ♀; Ele-Ele, Fortín Campero, Rio Lipeo, San Lorenzo.

Sublegatus modestus modestus (Wied)

Recorded from Trinidad, Rio Mamoré (Zimmer).

Sublegatus modestus brevirostris (d'Orbigny and Lafresnaye)

10 ♂, 3 ♀; Ele-Ele, Todos Santos, Tomina, Bermejo, Entre Rios, Fortín Campero, La Merced, San Lorenzo.

Phaeomyias murina murina (Taczanowski)

Recorded from Province of Sara by Zimmer (Amer. Mus. Novit., no. 1109, 1941, p. 10).

Phaeomyias murina ignobilis Bond and de Schauensee

Not. Naturae, no. 93, 1941, p. 5 (Villa Montes, Dept. Tarija, Bolivia).

15 ♂, 11 ♀; Chatarona, Ele-Ele, Todos Santos, Lagunillas, Samaipata, Tomina, Entre Rios, Villa Montes.

Phaeomyias murina wagae (Taczanowski)

Recorded from northwestern Bolivia (Yungas of La Paz). We have no Bolivian specimens.

Camptostoma obsoletum bolivianum (Zimmer)

Amer. Mus. Novit., no. 1109, May 15, 1941, p. 14 (Pulque, Prov. Sucre, Bolivia).

Camptostoma obsoletum boliviana Gyldenstolpe, Arkiv för Zool., 33 B, no. 13, May 28, 1941, p. 5 (Illataco, Dept. Cochabamba, Bolivia).

9 ♂, 10 ♀; Todos Santos, Huanay, Lagunillas, Samaipata, Tomina, Bermejo, Entre Rios, San Lorenzo, Villa Montes.

The males from the above localities have wings measuring 57-62 mm. Tarija birds (males) have wings of 60.5-62 mm. and are thus referable to this large race rather than to the nominate form which occurs in Tucumán.

Camptostoma obsoletum cinerascens (Wied)

♂, 2 ♀; Chatarona (600 ft.).

Recorded from eastern Bolivia (plains of Chiquitos). A male (t. s. e.) and two females from Chatarona are small (wing 54-54.5 mm.) and are probably referable to *cinerascens*.

Xanthomyias sclateri sclateri (Berlepsch)

17 ♂, 9 ♀, 4 o; Palmar, Samaipata, Rio Azero, Bermejo, Entre Rios, Rio Lipeo.

Tyranniscus uropygialis (Lawrence)

3 ♂, ♀; Hichuloma, Chorros, Padilla.

Tyranniscus bolivianus bolivianus (d'Orbigny)

8 ♂, 8 ♀; Sandillani, Incachaca, Yungas of Cochabamba (4500 and 8000 feet).

In addition to the above specimens, we have an example labeled "Musc. no. 66 d'Orbigny, Yungas, Bolivia, V. M."

Tyranniscus gracilipes gilvus (Zimmer)

Amer. Mus. Novit., no. 1109, 1941, p. 23 (La Pampa, southeast Peru).

3 ♂ ; Huanay, Todos Santos.

Tyrannulus elatus benii Carriker

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 336 (Chatarona, Dept. Beni, Bolivia).

♂ , ♀ ; Chatarona.

This race barely differs from the nominate form by having the sides of the head slightly grayer. No other character given by Carriker is constant and further specimens may show *benii* to be invalid.

Acrochordopus burmeisteri (Cabanis and Heine)

♂ ; Samaipata.

Ornithion inerme Hartlaub

Recorded from Bolivia by Zimmer on the basis of a specimen in the Rusby Collection with no precise locality (Amer. Mus. Novit., no. 1126, 1941, p. 4). Mr. Zimmer informs us that the data accompanying Rusby's specimens cannot always be relied upon.

Leptopogon superciliaris albidiventer Hellmayr

9 ♂ , 6 ♀ , 0; Calabatea, Sandillani, Palmar, Santa Ana, San Jacinto, Yungas of Cochabamba.

Leptopogon amaurocephalus amaurocephalus Tschudi

4 ♂ , 2 ♀ ; Santa Ana, Rio Lipeo.

Our specimens have wings measuring 66.5-70 mm. Santa Ana birds appear closer to the nominate form than to *peruvianus*. The Tarija birds are more suffused with olive-yellow on the under parts than the Santa Ana specimens.

Leptopogon amaurocephalus peruvianus Sclater and Salvin

♀ ; Susi.

This specimen is obviously referable to this smaller and darker race (wing 64.5 mm.).

Mionectes striaticollis striaticollis (Lafresnaye and d'Orbigny)

6 ♂ , 8 ♀ , 3 0; Sandillani, Incachaca, Palmar, San Jacinto, Yungas of Cochabamba.

Pipromorpha oleaginea chloronota (d'Orbigny and Lafresnaye)

2 ♂ ; Palmar, Todos Santos.

We follow Zimmer in referring our specimens to *chloronota* (Amer. Mus. Novit., no. 1126, 1941, p. 11).

Pipromorpha macconnelli amazona Todd

2 ♂ , ♀ ; Susi, Chifñiri, Buenavista.

Family **PIPRIDAE** (Manakins)

Piprites chloris bolivianus Chapman

3 ♂, 3 ♀; Santa Ana, Calabatea.

Pipra coronata regalis Bond and de Schauensee

Not. Naturae, no. 44, 1940, p. 4 (Palmar, 2600 ft., Dept. Cochabamba, Bolivia).

♂, ♀; Palmar.

Pipra fasciicauda fasciicauda Hellmayr

8 ♂, ♀; mouth of the Rio Chapare, Todos Santos.

Pipra chloromeros Tschudi

4 ♂, 7 ♀; Chiniñiri, Palmar.

Chiroxiphia pareola boliviana Allen

16 ♂, 8 ♀; Calabatea, Sandillani, Palmar, Santa Ana, Yungas of Cochabamba, Samaipata.

Schiffornis turdinus steinbachi Todd

7 ♂, 5 ♀; Calabatea, Chiniñiri, Palmar, Santa Ana, Rio Surutú.

Neopelma sulphureiventer (Hellmayr)

Elaenia viridicata huallagae Carriker, Proc. Acad. Nat. Sci. Phila., 86, 1934, p. 327 (Shapaja, Rio Huallaga, Peru).

13 ♂, 3 ♀; Chiniñiri, Todos Santos, mouth of the Rio Chapare, Teoponte.

Bolivian specimens appear identical with those from Peru.

Family **COTINGIDAE** (Cotingas)

Laniisoma elegans cadwaladeri Carriker

Laniisoma cadwaladeri Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 329 (Santa Ana, Rio Coroico, Dept. La Paz, Bolivia).

♂ (type); Santa Ana.

At our request J. L. Peters has compared the type of *remigialis* Lafresnaye in the Museum of Comparative Zoölogy with the above specimen. He writes: "There are a few very slight differences which might well be due to age as much as anything else. For instance, the type of *remigialis* has a few semi-concealed blackish marks on the feathers of the middle and sides of the throat; I should also say that *remigialis* has slightly narrower and perhaps less regular barring on the flanks than Carriker's bird, but this may be due to make of skin. There is also a very slight difference in size."

The type of *remigialis*, which is not sexed but must be a male, has a wing of 98.7 as against 102 mm. No locality is given on the label and Peters believes that the bird was not of d'Orbigny origin and perhaps, therefore, did not come from Bolivia.

In view of the fact that a race *L. e. venezuelensis* Phelps and Gilliard, exceedingly close to *cadwaladeri*, has recently been described from Venezuela (Amer. Mus. Novit., no. 1153, 1941, p. 5), we think it best not to identify *remigialis* with *cadwaladeri* or *venezuelensis* until further specimens of the forms of this little known genus are forthcoming. Incidentally, it is worth noting that the unique type of *venezuelensis*, which we have examined, has likewise a shorter wing (96.5 mm.) than *cadwaladeri*.

It is possible that the name *remigialis* is applicable to *buckleyi* (Sclater and Salvin), the latter based on females from east Ecuador (adult male unknown).

Phibalura flavirostris boliviana Chapman

Auk, 47, 1930, p. 88 (Atten, Aplobamba, Bolivia).

Known only from the type locality.

Heliochera rubro-cristata (Lafresnaye and d'Orbigny)

5 ♂, ♀; Hichuloma, Viloca, Chorros, Incachaca.

Cotinga cayana (Linnaeus)

Recorded from northern Bolivia ("Yuracaré"; lower Beni). We have no Bolivian specimens.

Pipreola intermedia signata (Hellmayr)

11 ♂, 3 ♀, 0; Sandillani, Incachaca, San Cristobal.

Pipreola frontalis frontalis (Sclater)

3 ♀; San Jacinto, Samaipata.

Pipreola arcuata (Lafresnaye)

3 ♂, ♀, 0; Sandillani, Incachaca, San Cristobal.

Attila spadiceus spadiceus (Gmelin)

♂ (juv.); Palmar.

Attila bolivianus bolivianus Lafresnaye

5 ♂, 3 ♀, 0; Chatarona, Susi, Chiniñiri, mouth of the Rio Chapare, Todos Santos.

Casiornis rufa (Vieillot)

10 ♂, 11 ♀, 0; Mouth of the Rio Chapare, Todos Santos, Lagunillas, Samaipata, Rio Azero, Villa Montes.

Laniocera hypopyrrha (Vieillot)

♂; Susi.

Rhytipterna simplex intermedia Zimmer

Amer. Mus. Novit., no. 893, 1936, p. 11 (Igarapé Brabo, left bank of Rio Tapajós, Brazil).

♂; Santa Ana.

Lipaugus cineraceus (Vieillot)

♂ ; Chiñiri.

Chirocylla uropygialis (Sclater and Salvin)

♂ ; Sandillani.

Pachyramphus viridis viridis (Vieillot)

2 ♂, 2 ♀ ; Rio Lipeo, Villa Montes.

Pachyramphus versicolor meridionalis Carriker

Proc. Acad. Nat. Sci. Phila., 86, 1934, p. 319 (Rio Jelashte, Dept. San Martin, Peru).

♂ ; Incahaca.

Our specimen is not fully adult.

Pachyramphus castaneus amazonus Zimmer

Amer. Mus. Novit., no. 894, 1936, p. 6 (Rosarinho, left bank of the Rio Madeira, Brazil).

Recorded from "La Paz", but possibly taken from near the falls of the Rio Madeira (Zimmer).

Pachyramphus polychopterus spixii (Swainson)

12 ♂, 8 ♀ ; mouth of the Rio Chapare, Palmar, Santa Ana, Todos Santos, Samaipata, Tomina, Teoponte, Buenavista.

An adult male from Teoponte has a wing of 81 mm. and is nearest in size to *spixii*, being decidedly larger than Peruvian specimens of *niger*, so that it would appear that birds from the Rio Beni should be placed with *spixii*, rather than with *niger* as surmised by Zimmer (Amer. Mus. Novit., no. 894, 1936, p. 12).

Pachyramphus marginatus subsp.

2 ♂ (1 immat.) ; Teoponte.

We are informed by Zimmer that there are three recognizable races of this species. The nominate form is confined to the coastal section of southern Brazil; another form inhabits most if not all of the remainder of the territory south of the Amazon, while the third inhabits northern South America, north of the Amazon. The three races are characterized chiefly by color differences in the females. Until topotypical females of *P. m. nanus* Bangs and Penard (type locality = Xeberos, Peru) are available, or at least specimens from west of the Rio Huallaga in northern Peru, it is impossible to say which form is *nanus*.

The wing of our adult male measures 69.25, that of the immature male 66 mm.

Platyparus rufus rufus (Vieillot)

Recorded from eastern Bolivia (Chiquitos).

Platypsaris rufus audax (Cabanis)

7 ♂, 5 ♀; Sandillani, Todos Santos, Samaipata, Padilla, Tomina, Villa Montes.

Platypsaris minor (Lesson)

3 ♂; Santa Ana.

Tityra cayana cayana (Linnaeus)

♂, ♀; Buenavista.

The female with a black pileum is typical of the nominate form.

Tityra cayana braziliensis (Swainson)

♀; Chatarona.

This bird shows all the characters of this subspecies, e. g., streaked pileum, bill reddish only at base, heavy streaking on under parts.

Tityra semifasciata fortis Berlepsch and Stolzmann

3 ♂, ♀; Calabatea, Chiniñiri, Palmar, Santa Ana.

Tityra inquisitor pelzelni Salvin and Godman

♂; mouth of the Rio Chapare.

Querula purpurata (Müller)

♂, ♀; Chatarona.

New to Bolivia.

Cephalopterus ornatus ornatus Geoffroy Saint-Hilaire

♂, 3 ♀; Palmar, Santa Ana.

Gymnoderus foetidus (Linnaeus)

3 ♀; Mouth of the Rio Chapare, Todos Santos.

Family **RUPICOLIDAE** (Cocks-of-the-Rock)**Rupicola peruviana saturata** Cabanis and Heine

6 ♂, 5 ♀; Calabatea, Palmar, San Jacinto, Santa Ana.

Family **PHYTOTOMIDAE** (Plant-cutters)**Phytotoma rutila angustirostris** Lafresnaye and d'Orbigny

21 ♂, 12 ♀, o; Calacoto, Lagunillas, Oploca, Entre Rios, La Merced, San Lorenzo, Villa Montes.

Suborder **OSCINES**Family **CORVIDAE** (Crows and Jays)**Cyanocorax chrysops chrysops** (Vieillot)

6 ♂, 7 ♀; Chatarona, mouth of the Rio Chapare, Samaipata, Rio Lipeo.

Our specimens vary in size (wing 151 to 163 mm.), the largest being a female from the Rio Beni in the north. Specimens from Tarija show no approach in size to the supposedly larger *tucumanus*.

Cyanocorax cyanomelas (Vieillot)

6 ♂, 7 ♀; Chatarona, Sandillani, Palmar, San Jacinto, Yungas of Cochabamba, Lagunillas, Samaipata, Rio Azero, Entre Rios.

A single male from Chatarona appears identical with Paraguayan and south Bolivian specimens.

Xanthoura yncas yncas (Boddaert)

4 ♂, ♀; Calabatea, Incachaca, San Jacinto.

Cyanolyca viridi-cyana viridi-cyana (Lafresnaye and d'Orbigny)

10 ♂, 8 ♀; Sandillani, Chorros, Incachaca, San Cristobal.

Family **CINCLIDAE** (Dippers)**Cinclus leucocephalus leucocephalus** Tschudi

4 ♂, 3 ♀; Hichuloma, Incachaca, Samaipata.

Not previously recorded from the Department of Santa Cruz.

Family **TROGLODYTIDAE** (Wrens)**Cinnycerthia fulva** (Sclater)

4 ♂, ♀; Sandillani, Incachaca.

Cistothorus platensis graminicola Taczanowski

Recorded from Khapaguaia in northwestern Bolivia. We have only Peruvian specimens.

Cistothorus platensis boliviae Bond and de Schauensee

Not. Naturae, no. 93, 1941, p. 6 (Samaipata, Dept. Santa Cruz, Bolivia).

9 ♂, 4 ♀, o; Hichuloma, Viloca, Samaipata.

Perhaps the record of this species from Khapaguaia in northwestern Bolivia pertains to this form.

Heleodytes turdinus hypostictus (Gould)

Heleodytes turdinus chanchamayoensis Carriker. Proc. Acad. Nat. Sci. Phila., 85, 1933, p. 32 (San Juan de Perené, Dept. Junin, Peru).

Known from the lower Beni and falls of the Rio Madeira, Bolivia. A specimen in the American Museum of Natural History from the lower Beni (Rusby Collection) is indistinguishable from a female from Sarayacu, which is a virtual topotype of *hypostictus*. In view of the considerable variation in the form and profusion of the markings of the under parts throughout the range of this race we do not see how Carriker's race can be maintained. Nevertheless, in series, birds from southern Peru have the under parts on the average less heavily spotted than those from farther north (cf. Seilern, Ann. Natur. Mus. Wien, 47, 1934 = 1936?, pp. 33-41).

Heleodytes unicolor (Lafresnaye)

3 ♂, 5 ♀; Chatarona, mouth of the Rio Chapare.

Related to and apparently representative of the preceding species. Our Bolivian and Matto Grosso specimens do not have smaller and slenderer bills than *hypostictus* (cf. Hellmayr, Cat. Bds. Amer., 13, pt. 7, 1934, p. 134, footnote).

Thryothorus guarayanus (Lafresnaye and d'Orbigny)

6 ♂, 2 ♀, 2 o; Chatarona, mouth of Rio Chapare.

Wing measurements of the males vary between 60-64 mm.; of the females, 55-56.5 mm.

Thryothorus genibarbis juruanus Ihering

A poorly marked form which has been recorded from the falls of the Rio Madeira, Dept. Beni.

Thryothorus genibarbis bolivianus (Todd)

20 ♂, 2 ♀; Calabatea, Chiñiri, Huanay, Palmar, Todos Santos, Lagunillas, Rio Surutú, Teoponte.

Troglodytes musculus rex Berlepsch and Leverkühn

25 ♂, 13 ♀, o; Huanay, Santa Ana, Chatarona, Ele-Ele, mouth of Rio Chapare, San Cristobal, Tiraque, Tutimayo, Lagunillas, Rio Surutú, Samaipata, Oplaca, Tomina, Entre Rios, Fortín Campero, La Merced, Rio Lipeo, San Lorenzo, Tarija.

Specimens taken in La Paz below 2500 ft. (Huanay, Santa Ana) are virtually indistinguishable from *rex* and can not be referred to *carabayae* of southeast Peru.

Troglodytes musculus puna Berlepsch and Stolzmann

6 ♂, 2 o; Calacoto, Sandillani, Tanapacá, "La Paz" (d'Orbigny).

These specimens average paler below than examples from Desaguadero, Titicaca, Peru, thus approaching *rex*.

Troglodytes solstitialis frater Sharpe

13 ♂, 17 ♀; Sandillani, Incachaca, San Cristobal, San Jacinto, Samaipata, Padilla, Tarija.

The single specimen from Tarija shows none of the characters ascribed to *T. s. auricularis* Cabanis.

Henicorhina leucophrys boliviana Todd

11 ♂, 11 ♀; Calabatea, Sandillani, Incachaca, San Cristobal, San Jacinto, Yungas of Cochabamba, Samaipata.

Six specimens were collected at Samaipata, apparently the first record of this form from the Department of Santa Cruz, the species having hitherto been known (in Bolivia) only from the Departments of Cochabamba and La Paz.

Microcerculus marginatus marginatus (Sclater)

Microcerculus marginatus bolivianus Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 337 (Santa Ana, Rio Coroico, Dept. La Paz, Bolivia).

4 ♂, 4 ♀; Palmar, Santa Ana, Teoponte.

The plumages of this bird are very complicated. Carriker compared his Bolivian birds with specimens from Peru, the plumages of which were not comparable. On the average, Bolivian birds have the flanks darker, less rufous, but a comparable specimen from Puerto Jessup is identical with Bolivian examples in this respect. With more material a Bolivian race may be separable but we doubt it.

Leucolepis arada modulatrix (d'Orbigny)

3 ♀; Todos Santos.

Family **MIMIDAE** (Mockingbirds and Thrashers)**Mimus saturninus frater** Hellmayr

♂, ♀; Chatarona.

Mimus saturninus modulator (Gould)

6 ♂, 3 ♀; Lagunillas, Entre Rios, San Lorenzo, Villa Montes.

Mimus dorsalis (Lafresnaye and d'Orbigny)

20 ♂, 15 ♀, 0; Calacoto, Cochabamba, Tiraque, Tutimayo, Callipampa, Catavi, Oploca, Potosí, La Merced, San Lorenzo.

Mimus triurus (Vieillot)

5 ♂, 7 ♀; Todos Santos, Buenavista, Fortín Campero, San Lorenzo, Villa Montes.

Donacobius atricapillus albo-vittatus Lafresnaye and d'Orbigny

2 ♂, 3 ♀; Chatarona, Todos Santos.

Family **TURDIDAE** (Thrushes)**Turdus albicollis contemptus** Hellmayr

3 ♂, 9 ♀; Calabatea, Sandillani, Samaipata, Rio Azero.

The Rio Azero specimens agree with those from the Departments of La Paz and Santa Cruz, whence this form has previously been recorded.

Turdus albicollis berlepschi Todd

We have no specimens of this thrush from Bolivia, whence it has been recorded from the falls of the Madeira, Dept. Beni.

Turdus haplochrous Todd

Known only from eastern Bolivia (Rio San Julian, Chiquitos). We have no specimens of this interesting thrush, which is evidently related to the widespread *T. nudigenis*.

***Turdus fumigatus fumigatus* (Lichtenstein)**

Recorded from eastern Bolivia (Chiquitos). We have no specimens from this republic.

***Turdus fumigatus hauxwelli* Lawrence**

4 ♂, 0; Mouth of Rio Chapare.

These specimens show no approach to the nominate form.

***Turdus ignobilis debilis* Hellmayr**

A specimen of this thrush, collected by Rusby, is in the collection of the American Museum of Natural History. On the label is written "Yungas, Bolivia, S. 18°, 6000 ft." The locality is probably erroneous, since Rusby is known to have labeled his specimens after his return from his expedition. Zimmer writes us that the specimen was perhaps taken at the falls of the Madeira, since this thrush is known from the Rio Madeira somewhat farther to the north.

***Turdus amaurochalinus* Cabanis**

Turdus ignobilis sandiae Carriker, Proc. Acad. Nat. Sci. Phila., 85, 1933, p. 34 (Huacayo, Prov. Sandia, Dept. of Puno, Peru).

21 ♂, 12 ♀; Chatarona, Susi, Chifiri, Huanay, Ele-Ele, mouth of the Rio Chapare, Palmar, Santa Ana, Samaipata, Tomina, Bermejo, Entre Rios, Fortín Campero, San Lorenzo, Villa Montes.

***Turdus rufiventris rufiventris* Vieillot**

14 ♂, 9 ♀; Samaipata, Padilla, Rio Azero, Bermejo, Entre Rios, La Merced, Rio Lipeo.

Our specimens show much variation, particularly in the color of the upper parts, and can be matched by examples from southeast Brazil. We feel that *T. r. chacoensis* Brodkorb (Proc. Biol. Soc. Wash., 52, 1929, p. 84, km. 195, west of Puerto Casado, Paraguay) may be based on seasonal or individual variation.

***Turdus nigriceps* Cabanis**

14 ♂, 8 ♀; Palmar, Samaipata, Padilla, Tomina, Rio Lipeo.

These specimens agree with a good series from Peru.

***Turdus serranus serranus* Tschudi**

12 ♂, 7 ♀; Incachaca, San Cristobal, San Jacinto, Rio Lipeo.

***Turdus fuscater fuscater* Lafresnaye and d'Orbigny**

3 ♂, 3 ♀, 0; Hichuloma, Incachaca, Chorros.

***Turdus chiguanco chiguanco* Lafresnaye and d'Orbigny**

Recorded from the Department of La Paz (Cusillani).

***Turdus chiguanco anthracinus* Burmeister**

17 ♂, 11 ♀; Calacoto, Ele-Ele, Incachaca, Tiraque, Tutimayo, Samaipata, Callipampa, Catavi, Llallagua, Opoloca, Padilla, Tomina, San Lorenzo.

Specimens from Incachaca and Ele-Ele have more or less fulvous on the under wing-coverts and axillars, in this respect approaching the northern race.

Platycichla flavipes leucops (Taczanowski)

2 ♂, ♀; Calabatea, Samaipata.

The males had enlarged testes. The genus *Platycichla* has apparently never previously been recorded from Bolivia.

Myadestes ralloides ralloides (d'Orbigny)

♀; Palmar.

Entomodestes leucotis (Tschudi)

4 ♂, ♀; Sandillani, Incachaca, San Jacinto.

These specimens agree well with a small series from Peru. The genus appears not to have been taken previously in Bolivia.

Hylocichla ustulata swainsoni (Tschudi)

5 ♂; Calabatea, Samaipata, Rio Azero, Entre Rios.

Taken from October 20 to November 22.

Catharus dryas maculatus (Sclater)

8 ♂, ♀; Sandillani, Palmar, Samaipata, Rio Lipeo, Rio Azero.

Catharus fuscater mentalis Sclater and Salvin

This form is known only from the Department of La Paz.

Family **SYLVIIDAE** (Gnatcatchers and Allies)

Polioptila dumicola dumicola (Vieillot)

17 ♂, 6 ♀, 0; Ele-Ele, Lagunillas, Samaipata, Tomina, Bermejo, Entre Rios, Fortín Campero, Rio Lipeo, Villa Montes.

These birds were breeding in October, November, and December.

Polioptila dumicola berlepschi Hellmayr

3 ♂, 0; Chatarona.

Family **HIRUNDINIDAE** (Swallows)

Progne chalybea domestica (Vieillot)

This martin has been recorded from eastern Bolivia (Buenavista, Santa Cruz).

Progne modesta elegans Baird

2 ♂, ♀; Bermejo.

These specimens, taken September 10, were not in breeding condition.

Phaeoprogne tapera fusca (Vieillot)

2♂, 3♀; Chatarona, Lagunillas.

The specimens taken at Lagunillas in November have the chest decidedly darker than those taken at Chatarona in September.

Petrochelidon andecola andecola (Lafresnaye and d'Orbigny)

10♂, 4♀, 0; Cerro del Juno, Callipampa, Llallagua, Oploca, San Lorenzo, La Cumbre (Yungas Railroad).

Apparently the only specimen in breeding condition was a male taken at La Cumbre (15,000 ft.) in January.

Stelgidopteryx ruficollis ruficollis (Vieillot)

6♂, ♀; Susi, Todos Santos, Lagunillas, Fortín Campero.

Specimens in breeding condition were taken in September and November.

Alopochelidon fucata (Temminck)

♂; Ele-Ele.

This specimen, taken in October, had enlarged testes.

Pygochelidon cyanoleuca cyanoleuca (Vieillot)

3♂, 4♀, 20; Incachaca, Oploca, Callipampa.

Two specimens taken at Oploca in February and two collected at Callipampa in March are immature with dull upper parts and under tail-coverts with grayish margins.

Pygochelidon cyanoleuca patagonica (Lafresnaye and d'Orbigny)

♂; Fortín Campero.

The single male from the Department of Tarija is obviously referable to the southern race, the shorter under tail-coverts being conspicuously white. The wings too are paler than in specimens of *cyanoleuca*.

Atticora fasciata (Gmelin)

2♂, ♀; Chiniñiri, Santa Ana.

The birds from Chiniñiri were in breeding condition and were taken in July and August.

Orochelidon murina cyanodorsalis Carriker

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 338 (Hichuloma, Dept. La Paz, Bolivia).

3♂, 3♀; Hichuloma.

This recently described swallow is at once distinguishable from the nominate form in having the mantle steel-blue with little or no greenish tinge.

Riparia riparia r'paria (Linnaeus)

Recorded from Bolivia by Naumburg (Bull. Am. Mus. Nat. Hist., 60, 1930, p. 314).

Hirundo rustica erythrogaster Boddaert

♂ ; Oploca.

Taken March 2.

Iridoprocne albiventer (Boddaert)

♂ , ♀ ; Palmar.

Iridoprocne leucorrhoa (Vieillot)

♂ , ♀ ; Chatarona, Fortín Campero.

The male, taken at Chatarona was breeding in September.

Allen's record of *I. leucopyga* (Meyen) from Bolivia is doubtlessly based on a wrongly labeled Chilean bird (Hellmayr, Birds of Chile, p. 49, footnote).

Family **MOTACILLIDAE** (Wagtails and Pipits)

Anthus furcatus brevisrostris Taczanowski

9 ♂ , 4 ♀ ; Callipampa, Cataví, Uncia, San Lorenzo.

Anthus hellmayri subsp.

Anthus bogotensis pallidus Carriker, Proc. Acad. Nat. Sci. Phila., 85, 1933, p. 34 (Oco-neque, Peru).

9 ♂ , 4 ♀ ; Samaipata, Chorros, Padilla, San Lorenzo, Tutimayo.

These birds are easily distinguishable from *A. f. brevisrostris* by their shorter wings. Nine males of *hellmayri* have wings of 73-78, four females 74-75, as against 84-87 for males and 80-81 mm. for females of *brevirostris*. They are further distinguishable by more buffy abdomen, narrower streaking of the chest and by having the penultimate rectrix either unmarked, or with a small whitish tip, instead of having a broad white streak on the inner web next to the shaft.

We have no authentic specimen of *A. h. dabbenei* which breeds in Chile and the Argentine, south of the known range of the nominate form, and which is said to migrate north to Tucumán. Our birds were taken during January, March, July, October, and November, and were in breeding condition from November to January. An immature bird was collected in March. In only one specimen is the white spot on the penultimate rectrix lacking. Our birds, therefore, would appear to belong to *dabbenei*, although the breeding form from Bolivia should be *hellmayri* according to the range given by Hellmayr. The species appears not to have been previously recorded definitely from Bolivia.

Anthus lutescens lutescens Pucheran

6 ♂ , 3 ♀ ; Fortín Campero.

Anthus correndera catamarcae Hellmayr

11 ♂ , 3 ♀ , 0 ; Llica, Oploca.

The specimen from Llica is immature and decidedly paler than the rest of the series. This species has not previously been recorded from Bolivia.

Anthus bogotensis bogotensis Sclater

5 ♂, 3 ♀; Hichuloma, Cerro del Juno, Incachaca.

These birds from Bolivia appear to be indistinguishable from Peruvian specimens (*A. b. immaculatus* Cory), seven specimens from Colombia and three specimens from Ecuador (*A. b. bogotensis*).

Family **VIREONIDAE** (Vireos)**Vireo olivaceus olivaceus** Vieillot

This North American migrant has been recorded as far south as Bolivia.

Vireo olivaceus chivi (Vieillot)

10 ♂, 11 ♀, 0; Huanay, Palmar, Santa Ana, Samaipata, Teoponte, Entre Rios, Villa Montes.

Vireo olivaceus flavoviridis (Cassin)

Recorded by Zimmer from Tres Arroyos, mouth of the Rio San Antonio, and from the Provincia Sara (Amer. Mus. Novit., no. 1127, 1941, p. 13).

Vireo gilvus laetissimus (Todd)

9 ♂, 4 ♀, 0; Sandillani, Incachaca, Samaipata.

Hylophilus thoracicus aemulus (Hellmayr)

4 ♂, 1 ♀; Chiniñiri, Santa Ana.

This bird has not previously been recorded from Bolivia.

Hylophilus flaviventris Cabanis

5 ♂, 2 ♀, 0; Susi, Palmar, Santa Ana, Teoponte.

One male taken in July was in breeding condition. These birds agree with two from La Pampa, Sandia, Peru. The species has not hitherto been recorded from Bolivia.

Hylophilus ochraceiceps viridior (Todd)

7 ♂, 4 ♀; Chiniñiri, Palmar, Santa Ana, Teoponte.

Family **VIREOLANIIDAE** (Shrike-Vireos)**Smaragdolanus leucotis bolivianus** (Berlepsch)

2 ♂, 2 ♀; Palmar, Santa Ana.

Family **CYCLARHIDAE** (Pepper Shrikes)**Cyclarhis gujanensis gujanensis** (Gmelin)

Cyclarhis gujanensis albiiventris Carriker, Proc. Acad. Nat. Sci. Phila., 82, 1930, p. 375 (Eneñas, Junin, Peru).

3 ♂, 2 ♀, ♂ (juv.); Huanay, Santa Ana.

Cyclarhis gujanensis pax Bond and de Schauensee

Not. Naturae, no. 105, 1942, p. 3 (Sandillani, 6800 ft., Yungas of La Paz, Bolivia).

♂ (type); Sandillani.

Cyclarhis gujanensis dorsalis Zimmer

Amer. Mus. Novit., no. 1160, 1942, p. 13 (Parotani, Dept. Cochabamba, Bolivia).

8 ♂, 2 ♀; Ele-Ele, Lagunillas, Tomina, Padilla.

A male from Padilla and another from Tomina show an approach to *viridis*, but others taken at these localities during the same season are typical *dorsalis*.

Cyclarhis gujanensis viridis (Vieillot)

3 ♂, 2 ♀; Samaipata.

These specimens agree best with *viridis*.

Cyclarhis gujanensis cearensis Baird

Recorded from the plains of Chiquitos in eastern Bolivia.

Cyclarhis gujanensis tarijae Bond and de Schauensee

Not. Naturae, no. 105, 1942, p. 2 (Rio Lipeo, 2100 ft., Dept. Tarija, Bolivia).

6 ♂, 4 ♀; Bermejo, La Merced, Rio Lipeo, Villa Montes, Fortín Campero.

Family **COEREVIDAE** (Honey-creepers)**Diglossa baritula sittoides** (Lafresnaye and d'Orbigny)

8 ♂, 2 ♀; Viloca, Incachaca, Samaipata, Padilla, Bermejo, La Merced.

Diglossa lafresnayii mystacalis Lafresnaye

4 ♂, 4 ♀; Hichuloma.

All specimens taken in December and January were breeding or about to breed. An immature male differs from the adult in being dull black above with no gloss and lacks the gray shoulder patches; below the feathers are edged with gray, and the malar streak is a dirty white rather than rufous; "bill yellowish, tip of culmen dusky." In adults the bill is black, leaden at base of mandible.

Diglossa brunneiventris Lafresnaye

4 ♂, ♀; Hichuloma.

These specimens are indistinguishable from a small series from Peru. Because of its very distinctive colour pattern we do not think this bird should be regarded as conspecific with *carbonaria*. Further, Carriker states that the two birds are "found together over a considerable area in northern Bolivia (both were taken at Calacoto)." There is no specimen of *brunneiventris* from Calacoto in Carriker's Collection.

Diglossa carbonaria carbonaria (Lafresnaye and d'Orbigny)

19 ♂, 9 ♀; Viloca, Chorros, Incachaca, Tiraque, Calacoto.

Diglossa glauca glauca Sclater and Salvin

2 ♂, 2 ♀; Palmar, San Jacinto.

Diglossa caerulescens pallida (Berlepsch and Stolzmann)

Recorded from northwestern Bolivia (Yungas of La Paz).

Diglossa cyanea melanopis Tschudi

21 ♂, 7 ♀; Sandillani, Incachaca, San Cristobal, San Jacinto.

Chlorophanes spiza caerulescens Cassin

6 ♂; Chiniñiri, Huanay, Palmar, Todos Santos, Teoponte.

Cyanerpes cyaneus violaceus Zimmer

Amer. Mus. Novit., no. 1203, 1942, p. 8 (Chapada, Matto Grosso, Brazil).

♂; Chatarona (culmen 12 mm.).

Cyanerpes caeruleus microrhynchus (Berlepsch)

2 ♂, 3 ♀; Todos Santos.

Dacnis cayana glaucogularis Berlepsch and Stolzmann

4 ♂, 2 ♀; Chatarona, Palmar, Todos Santos, Buenavista.

Dacnis lineata lineata (Gmelin)

3 ♂, ♀; Huanay, Palmar.

Dacnis flaviventer Lafresnaye and d'Orbigny

We have no specimens from Bolivia, whence this species has been recorded from Yuracarés, the type locality, and from the Rio San Mateo.

Coereba flaveola dispar Zimmer

Amer. Mus. Novit., no. 1193, 1942, p. 4 (Candamo, southeastern Peru).

7 ♂, 6 ♀; Sandillani, Palmar, Todos Santos, Rio Surutú.

Ateleodacnis speciosa speciosa (Temminck)

3 ♂, 3 ♀; Rio Lipeo.

Conirostrum sitticolor cyaneum Taczanowski

2 ♂, 3 ♀; Hichuloma, Incachaca.

Conirostrum ferrugineiventre Sclater

8 ♂, 4 ♀; Hichuloma, Chorros, Incachaca.

Conirostrum cinereum cinereum Lafresnaye and d'Orbigny

4 ♂; Viloca, Chorros.

These birds were breeding in April.

Conirostrum albifrons sordidum Berlepsch

♂, ♀; Sandillani.

Conirostrum albifrons lugens Berlepsch

6 ♂, 2 ♀; Incachaca, San Cristobal, San Jacinto, Samaipata.

A male from Oconeque, Peru, is indistinguishable from our Bolivian specimens of *lugens*.

Oreomanes fraseri sturninus Bond and de Schauensee

Not. Naturae, no. 12, 1939, p. 1 (Finca Salo, Oploca, 13,000 ft., Dept. Potosí, Bolivia).

2 ♂, ♀; Finca Salo (Oploca), Viloca.

These birds were found at an elevation of between 11,500 and 13,000 feet. The genus *Oreomanes* had not been known as far south as Bolivia.

Family **COMPSOTHYLIPIDAE** (Wood Warblers)**Compsothlypis pitiayumi pitiayumi** (Vieillot)

8 ♂, 10 ♀; Mouth of Rio Chapare, Lagunillas, Samaipata, Padilla, Bermejo, La Merced, Rio Lipeo, San Lorenzo, Villa Montes.

Two males, taken at Samaipata in November, were in breeding condition.

Compsothlypis pitiayumi melanogenys Todd

7 ♂, 4 ♀; Calabatea, Huanay, Ele-Ele, Palmar, Santa Ana.

These birds are slightly darker both above and below than specimens taken elsewhere in Bolivia (*C. p. pitiayumi*). Specimens taken in July and August were in breeding condition.

Dendroica cerulea (Wilson)

This migrant from North America has been recorded from Nairapi and Tilotilo in northeastern Bolivia.

Geothlypis aequinoctialis velata (Vieillot)

16 ♂, 5 ♀; Chatarona, Chifiri, mouth of Rio Chapare, Santa Ana, Todos Santos, Lagunillas, Samaipata, Rio Azero, Entre Rios, Villa Montes.

Myioborus miniatus verticalis (Lafresnaye and d'Orbigny)

3 ♂, 4 ♀; Calabatea, Palmar, Santa Ana, Yungas of Cochabamba.

Myioborus melanocephalus bolivianus Chapman

7 ♂, 10 ♀, 3 o; Hichuloma, Chorros, Incachaca.

Myioborus brunniceps brunniceps (Lafresnaye and d'Orbigny)

8 ♂, 8 ♀; Samaipata, Padilla, Tomina, Bermejo, Entre Rios, La Merced, Tarija.

Basileuterus nigro-cristatus euophrys Selater and Salvin

7 ♂, 4 ♀; Hichuloma, Sandillani, Incachaca.

Basileuterus signatus flavovirens Todd

12 ♂, 9 ♀; Hichuloma, Sandillani, Chorros, Incachaca, Samaipata.

Basileuterus flaveolus (Baird)

Recorded from the Chiquitos district of eastern Bolivia and from Santa Cruz.

Basileuterus bivittatus bivittatus (Lafresnaye and d'Orbigny)

14 ♂, 6 ♀, o; Calabatea, Palmar, Lagunillas, Samaipata, Rio Azero, Bermejo, Entre Rios, Rio Lipeo.

Basileuterus tristriatus punctipectus Chapman

7 ♂, 8 ♀, 3 o; Calabatea, Sandillani, Incachaca, Palmar, San Jacinto, Yungas of Cochabamba, Samaipata.

Basileuterus culicivorus viridescens Todd

6 ♂, ♀; Chatarona, mouth of Rio Chapare.

A tropical form hitherto recorded from the Department of Santa Cruz. Unlike most species of this genus, this bird was found well above the ground in the lower branches of trees.

Basileuterus coronatus notius Todd

♂, 5 ♀; Calabatea, Palmar, San Jacinto.

Basileuterus rivularis bolivianus Sharpe

6 ♂, 5 ♀; Susi, Calabatea, Palmar, Santa Ana.

Family **TERSINIDAE** (Swallow-Tanagers)

Tersina viridis viridis (Illiger)

5 ♂; Susi, Chifñiri, Buenavista.

A nesting burrow that contained one egg was found at Chifñiri.

Tersina viridis occidentalis (Sclater)

Recorded from northern Bolivia, south to the northern foot of the Bolivian Andes (Yungas of La Paz).

Family **THRAUPIDAE** (Tanagers)

Chlorophonia cyanea longipennis (Du Bus)

2 ♂, ♀; Palmar.

Carriker, in identifying two birds from La Oroya, Peru, as *Chlorophonia torrejoni* Tacz., had but two not fully adult specimens of *Ch. c. longipennis* with green backs. Neither is marked as breeding (cf. Proc. Acad. Nat. Sci. Phila., 83, 1931, pp. 466-467 (1932)).

Tanagra musica aureata Vieillot

4 ♂, 2 ♀; Chatarona, Samaipata, Tomina, La Merced.

Tanagra xanthogaster ruficeps (Lafresnaye and d'Orbigny)

11 ♂, 6 ♀; Sandillani, Palmar, San Jacinto, Yungas of Cochabamba.

Tanagra minuta mellea Bangs and Penard

♂; Teoponte.

This specimen has the under parts darker, more orange-yellow than the others we have examined from elsewhere in South America.

Tanagra chlorotica serrirostris (Lafresnaye and d'Orbigny)

17 ♂, 7 ♀; Chatarona, Ele-Ele, Samaipata, Tomina, La Merced, Rio Lipeo, San Lorenzo, Villa Montes.

An adult male from Chatarona shows no approach to the Peruvian *taczanowskii* (Sclater).

Tanagra lanirostris lanirostris (Lafresnaye and d'Orbigny)

7 ♂, 2 ♀; Chatarona, Huanay, mouth of the Rio Chapare, Santa Ana, Teoponte.

Young males resemble adult males except that the upper parts, not including the fore part of the pileum, are green as in females. The hind portion of the pileum and the sides of the head are more or less marked with blue. The under parts are more greenish than in adult males.

Tanagra rufiventris colorata Todd

Recorded from the Rio Surutú, Department of Santa Cruz.

Tanagra mesochrysa tavaræ Chapman

Tanagra mesochrysa yungae Bond and de Schauensee, Not. Naturae, no. 105, 1942, p. 3 (Palmar, 2600 ft., Yungas of Cochabamba, Bolivia).

2 ♂, ♀, o; Calabatea, Palmar.

Tanagra chrysopasta chrysopasta (Sclater and Salvin)

3 ♂, 3 ♀; Huanay, mouth of the Rio Chapare, Santa Ana, Teoponte.

Chlorochrysa calliparaea fulgentissima Chapman

♂; Yungas of Cochabamba.

This genus appears to be new to the Bolivian fauna. Both species of *Tanagrella* are said to occur south to the northern boundary of Bolivia but do not seem to have been definitely recorded from this republic.

Pipraeidea melanonota venezuelensis (Sclater)

5 ♂, 3 ♀; Chiniñiri, Santa Ana, La Merced, Rio Lipeo.

These birds are perhaps intermediate between this and the nominate form. One male from Venezuela has the mantle blacker than any Bolivian or Peruvian bird examined.

Calliste chilensis chilensis (Vigors)

7 ♂, 3 ♀, 2 o; Huanay, Santa Ana, Rio Coroico, Cerro Hosane (Dept. Santa Cruz), Palmar, Todos Santos, mouth of the Rio Chapare.

Calliste schrankii (Spix)

5 ♂, 5 ♀, o; Santa Ana, Palmar, mouth of the Rio Chapare.

Calliste punctata punctulata Sclater and Salvin

3 ♂, 2 ♀; Calabatea, Palmar.

Calliste xanthogastra Sclater

2 ♂, 4 ♀, o; Santa Ana, Chiniñiri, Calabatea.

Calliste arthus sophiae Berlepsch

5 ♂, 4 ♀, o; Palmar.

Calliste xanthocephala lamprotis Sclater

11 ♂, 14 ♀, 2 o; Yungas of Cochabamba, Incachaca, Sandillani, San Jacinto, Palmar.

Calliste chrysotis Du Bus

♂; Yungas of Cochabamba.

Our single specimen agrees perfectly with three males from the Rio Jelashte and Tamborapa, Peru, taken at altitudes of 4000 to 4500 feet. We, therefore, do not consider a Bolivian race *C. ch. cochabambae* (Todd) valid.

Calliste cyanotis cyanotis Sclater

♀; Calabatea.

Calliste cyanicollis cyanicollis (Lafresnaye and d'Orbigny)

3 ♂, ♀; Palmar, Calabatea.

Calliste nigro-cincta nigro-cincta (Bonaparte)

No specimens of this tanager, which has been recorded from Mapirí, northern Bolivia, were secured.

Calliste ruficervix fulvicervix Sclater and Salvin

♂, ♀; Yungas of Cochabamba, Incachaca.

Calliste mexicana boliviana (Bonaparte)

2 ♂, 4 ♀; Santa Ana, Huanay, Todos Santos, Chifñiri.

Calliste gyrola catharinae (Hellmayr)

6 ♂, 3 ♀; Huanay, Palmar, Santa Ana, Teoponte.

Calliste nigroviridis berlepschi Taczanowski

♂, 2 ♀; San Jacinto.

These birds agree perfectly with our series from Peru. The species has not previously been recorded from Bolivia.

Calliste vassorii atrocaerulea (Tschudi)

14 ♂, 11 ♀; Incachaca, Sandillani, Chorros, San Cristobal, San Jacinto.

Birds in immature plumage were taken in the months of January, March, June, and December.

One specimen from San Cristobal and one from Incachaca differ from the rest of the series in having the entire pileum, apart from the light nuchal spot, purplish blue instead of greenish blue, the light area being pure white, not tinged with straw-yellow. Another specimen from San Cristobal has the anterior portion of the pileum purplish blue, the light nuchal spot tinged with yellow, and the surrounding blue area with a greenish tinge as in the great majority of the series. These differences appear to be merely a result of individual variation, rather than of age.

Calliste argyrofenges argyrofenges Sclater and Salvin

8 ♂, 3 ♀; Yungas of Cochabamba, Samaipata.

This rare species was found in the upper Piedra Blanca valley. The race has been taken previously only at Tilotilo, Yungas of La Paz, the type locality.

The Peruvian form *C. a. caeruleigularis* (Carraker), the type of which and two other males are before us, are separable by their slightly bluer throat. The type, an adult male, does not differ from our Bolivian specimens in the color of the mantle or sides. The two remaining birds of the type series have the mantles more silvery but neither is fully adult. In the original description of *caeruleigularis*, Carraker claimed that the longer upper tail-coverts of his form were tipped with the same color as the mantle, but that in the nominate race the tips were black. This difference does not show in the series before us, for the longer upper tail-coverts are entirely black in all specimens, and the shorter upper tail-coverts are uniformly tipped with straw-yellow. At best *caeruleigularis* is not a very distinct race.

Iridosornis jelskii boliviana Berlepsch

♂, ♀; Hichuloma.

I. a. analis has been recorded from near the Bolivian border in the Marcapata Valley in Peru, but so far as we are aware no specimens have yet been taken in Bolivia.

Delothraupis castaneiventris (Sclater)

5 ♂, 4 ♀; Hichuloma, San Cristobal, Incachaca.

We are unable to recognize a Peruvian race (*D. c. peruvianus* Carraker). Bolivian specimens average slightly paler below and slightly smaller than those from Peru, but the differences are negligible.

Wing measurements of Peruvian specimens are: males 79-86.5 (three specimens), females 78-84.5 mm. (five specimens). Wings of Bolivian birds measure: males 77.5-83 (five specimens), females 76-83.25 mm. (four specimens).

Anisognathus igniventris igniventris (Lafresnaye and d'Orbigny)

10 ♂, 6 ♀; Incachaca, Hichuloma, Chorros.

Buthraupis montana montana (Lafresnaye and d'Orbigny)

4 ♂, 4 ♀; Sandillani, Hichuloma, San Cristobal, Incachaca, Chorros.

The blue margins to the rectrices are slightly paler, more greenish, in Cochabamba birds than in birds from La Paz.

Compsocoma flavinucha flavinucha (Lafresnaye and d'Orbigny)

20 ♂, 8 ♀, 0; Incachaca, Samaipata, Sandillani, San Jacinto, San Cristobal.

Thraupis episcopus boliviana Bond and de Schauensee

Not. Naturae, no. 93, 1941, p. 6 (Chatarona, Dept. Beni, Bolivia).

2♂, ♀, 0; Huanay, Chatarona.

Thraupis sayaca obscura Naumburg

13♂, 12♀; Samaipata, Sandillani, Tutimayo, Buenavista, Tomina, San Lorenzo, Rio Lipeo, Bermejo, Villa Montes, Entre Rios, La Merced.

Birds from higher altitudes (above 4600 ft.) average larger than lowland birds. Eight males from the mountains have wing measurements of 95-100 mm. (ave. 98 mm.) as against 94-97 mm. for four males from the lowlands (ave. 95.8 mm.). Four mountain females have wing-measurements between 93 and 97.5 mm., while three females from the lowlands have wings of 92, 92, 93 mm. In color they are indistinguishable.

Thraupis palmarum palmarum (Wied)

2♂; Buenavista.

Thraupis palmarum melanoptera (Sclater)

2♂, 2♀; Santa Ana, Palmar, Todos Santos.

Thraupis cyanocephala cyanocephala (Lafresnaye and d'Orbigny)

15♂, 6♀; Yungas of Cochabamba, Ineachaca, Sandillani, San Cristobal, San Jacinto.

Thraupis bonariensis bonariensis (Gmelin)

14♂, 12♀; Cochabamba, Ineachaca, Tutimayo, Tomina, Oplaca, San Lorenzo, La Merced, below Cataví, Villa Montes, Lagunillas.

The females have the pileum faintly washed with bluish in some individuals but never as strongly as in our single Bolivian female of *darwinii*. Males have wing measurements of 92-100 mm. and, therefore, cannot be regarded as belonging to the recently described *schulzei* Brodkorb, from Paraguay.

Thraupis bonariensis darwinii (Bonaparte)

2♂, ♀; Sandillani, Calacoto.

Ramphocelus carbo atrosericeus Lafresnaye and d'Orbigny

14♂, 10♀; Teoponte, Santa Ana, Buenavista, Chatarona, Sandillani, Palmar, Huanay, Todos Santos, Chifiri.

Juvenile males have the under parts suffused with dark red, whereas one immature male is entirely glossy black with red feathers showing on the gular area.

R. c. centralis Hellmayr may occur in the Chiquitos district.

Piranga rubra rubra (Linnaeus)

This migrant from North America has been recorded from San Antonio, Yungas of La Paz.

Piranga flava flava (Vieillot)

11 ♂, 7 ♀; Villa Montes, La Merced, Tomina, Samaipata, Rio Lipeo, Bermejo, Ele-Ele.

Males and females both show a considerable amount of variation as to the intensity of their colors.

Piranga flava rosacea Todd

♂; Chiquitos.

Piranga flava lutea (Lesson)

2 ♂, 2 ♀; Calabatea.

Recorded from the Yungas of La Paz and Cochabamba. One female from Ele-Ele, Dept. Cochabamba, is obviously referable to the nominate form.

Piranga olivacea (Gmelin)

Recorded from Pillon, Yungas of Bolivia, by Salvin and Godman.

Piranga leucoptera ardens (Tschudi)

♀; Palmar.

Chlorothraupis carmioli frenata Berlepsch

7 ♂, 8 ♀; Palmar, Chiniñiri.

The above specimens agree closely with our series from Peru. Owing to the fact that *Ch. olivacea* and *Ch. carmioli lutescens* have both been taken in eastern Darien at nearby localities (Cana-Tacarcuna), we think it preferable to regard *olivacea* as a distinct species. Carriker would make *carmioli* conspecific with *olivacea* (Proc. Acad. Nat. Sci. Phila., 87, 1935, pp. 338-339).

Habia rubica amabilis (Berlepsch)

12 ♂, 12 ♀; Palmar, Prov. de Sara, junction of Rios Chapare and Chimoré, Todos Santos, Santa Ana, Buenavista, Chiniñiri.

A nestling ♀, dull rufous brown in general coloration, was collected at Chiniñiri, August 31.

Lanio versicolor versicolor (Lafresnaye and d'Orbigny)

5 ♂, 2 ♀; Palmar, Chiniñiri.

Tachyphonus metallactus Oberholser

7 ♂, 3 ♀; Santa Ana, Chiniñiri.

Tachyphonus luctuosus luctuosus Lafresnaye and d'Orbigny

7 ♂, 7 ♀; Todos Santos, mouth of the Rio Chapare, Palmar.

Creurgops dentata (Sclater and Salvin)

♂, 0 (= ? ♂), 2 ♀; Sandillani (6800 ft.).

We agree with Carriker (Proc. Acad. Nat. Sci. Phila., 86, 1934, p. 332) that *Creurgops* and *Malacothraupis* are not generically separable. We

further believe that the species heretofore known as *Malacothraupis dentata* Selater and Salvin and *Malacothraupis gustavi* Berlepsch represent male and female of a single species. This has been suggested as a possibility by Hellmayr (Cat. Bds. Am., 13, pt. 9, 1936, pp. 346-347, foot-note). We cannot ascribe to coincidence the fact that Carriker collected, both on December 10 and 14, a male (*M. gustavi*) and a female (*M. dentata*). Carriker collected a specimen of *M. dentata* at Inca Mine, Peru, labeled male, but we believe this to be an incorrectly sexed bird. It is also significant to note that this bird was collected at the type locality of Chapman's *M. castaneiceps* which is a synonym of *M. gustavi*. Furthermore, the female of *gustavi* is said to be unknown. These facts make us feel it impossible to regard *gustavi* and *dentata* as different species.

In both sexes the sexual organs are recorded as slightly enlarged. The soft parts of both males and females are marked as follows: "Iris brown; bill black, flesh below, tip bluish; feet leaden blue."

Eucometis penicillata albicollis (Lafresnaye and d'Orbigny)

6 ♂, 4 ♀; mouth of the Rio Chapare, Todos Santos, Rio Chapare, Chatarona.

Trichothraupis melanops (Vieillot)

♂, ♀; Palmar, Lagunillas.

Cypsnagra hirundinacea hirundinacea (Lesson)

Recorded from the Chiquitos district.

Cypsnagra hirundinacea pallidigula Hellmayr

There is a specimen in the American Museum (Rusby Collection) labeled "Yungas, S. 18°, 6000 ft." (cf. Hellmayr, Cat. Bds. Amer., 13, pt. 9, p. 367, footnote). The locality is probably erroneous. It presumably came from the vicinity of the lower Beni.

Nemosia pileata paraguayensis Chubb

2 ♂, ♀; Villa Montes, Todos Santos, Chatarona.

One of the males is immature with the ear-coverts black and with traces of black on the pileum. There is a slight ochraceous-buff wash on the upper breast.

Hemithraupis guira guira Linnaeus

9 ♂, ♀; Bermejo, mouth of the Rio Chapare, Rio Lipeo, Teoponte, Santa Ana.

This species is greatly in need of revision.

Hemithraupis flavicollis centralis (Hellmayr)

Recorded from northern Bolivia (Simacu, Yungas of La Paz).

Thlypopsis sordida sordida (Lafresnaye and d'Orbigny)

11 ♂, 7 ♀, o; Rio Lipeo, Chatarona, Todos Santos, Lagunillas, Palmar, Villa Montes, Bermejo, Samaipata.

Thlypopsis ruficeps (Lafresnaye and d'Orbigny)

11 ♂, 9 ♀, 4 o; Palmar, Padilla, Yungas de Cochabamba, Incachaca, Hichuloma, Tanapacá, Samaipata, Chorros.

Chlorospingus ophthalmicus bolivianus Hellmayr

10 ♂, 3 ♀; San Cristobal, Sandillani, Calabatea.

Birds taken at Sandillani in November were in breeding condition.

Chlorospingus ophthalmicus fulvicularis Berlepsch

27 ♂, 15 ♀, 2 o; Samaipata, Incachaca, San Jacinto, Palmar.

Our specimens from Samaipata, the type locality, have the pectoral band averaging paler, more yellow, than in the remaining specimens. The pileum likewise averages paler.

Chlorospingus ophthalmicus argentinus Hellmayr

18 ♂, 4 ♀; Rio Lipeo, Rio Azero, Padilla, Bermejo, Tomina, Entre Rios.

Specimens taken in November, December, and January had enlarged testes.

Chlorospingus flavicularis flavicularis (Sclater)

Recorded from Simacu and Chaco, Yungas of La Paz.

Hemispingus atro-pileus calophrys (Sclater and Salvin)

2 ♂, ♀; Incachaca, Hichuloma.

Hemispingus melanotis castaneicollis (Sclater)

3 ♂, 4 ♀, o; Calabatea, San Jacinto, Sandillani.

Microspingus trifasciatus Taczanowski

3 ♂, 4 ♀; Hichuloma, Incachaca.

Females differ from the males in being paler below, but are similar above. The immature male resembles the female.

Neothraupis fasciata (Lichtenstein)

♂; Rio Aniser (1800 ft.), northern Chiquitos.

Chlorornis riefferii boliviana (Berlepsch)

3 ♂, 3 ♀; Sandillani, Incachaca.

This form extends northward into southeastern Peru, for we have five specimens from Oconeque which are indistinguishable from *boliviana* from La Paz, Bolivia.

Cissopis leveriana leveriana (Gmelin)

3 ♂, 2 ♀; Todos Santos, Palmar.

Schistochlamys melanopsis olivina (Sclater)

2 ♂; Chatarona.

Family **ICTERIDAE** (Troupials)

Gymnostinops yuracares yuracares (Lafresnaye and d'Orbigny)

♂, 2 ♀; Todos Santos.

Xanthornus decumanus maculosus (Chapman)

4 ♂, 6 ♀; Buenavista, Santa Ana, Chatarona, San Cristobal, Todos Santos, Entre Rios, Rio Azero, Palmar.

Xanthornus atro-virens (Lafresnaye and d'Orbigny)

6 ♂, 2 ♀; Sandillani, San Jacinto, Incachaca, Yungas of Cochabamba.

Xanthornus angustifrons alfredi (Des Murs)

3 ♂, 4 ♀; Palmar, Todos Santos, Santa Ana, Chiniñiri.

Cacicus cela cela (Linnaeus)

7 ♂, ♀; Buenavista, mouth of the Rio Chapare, Todos Santos, Huanay.

Archiplanus albirostris (Vieillot)

3 ♂, 2 ♀; Samaipata, Padilla.

Bills on all specimens noted as "pale leaden blue."

Archiplanus chrysonotus (Lafresnaye and d'Orbigny)

5 ♂, ♀; Incachaca, Chorros.

Our specimens show no trace of yellow on the wing-coverts and, therefore, do not approach *leucoramphus*.

Archiplanus solitarius (Vieillot)

♀; Villa Montes.

Amblycercus holosericeus australis Chapman

Recorded from Incachaca, Dept. Cochabamba.

Psomocolax oryzivorus oryzivorus (Gmelin)

♂, 3 ♀; Todos Santos, Susi, Chatarona.

Molothrus bonariensis bonariensis (Gmelin)

13 ♂, 5 ♀; Oploca, Samaipata, Lagunillas, Entre Rios, San Lorenzo, Fortín Campero, Tomina.

Molothrus rufo-axillaris Cassin

Recorded from Caiza in the Bolivian Chaco.

Molothrus badius bolivianus Hellmayr

8 ♂, 7 ♀; Oploca, Entre Rios, San Lorenzo, La Merced, Tutimayo, Ele-Ele.

Lamprospars tanagrinus boliviensis Gyldenstolpe

Arkiv för Zool., 33 B, no. 13, 1941, p. 4 (El Consuelo, Dept. El Beni, Bolivia).

Known only from the type locality.

Icterus cayanensis periporphyrus (Bonaparte)

♂, ♀, o; Todos Santos, Rio Chapare, Chiquitos.

Icterus cayanensis pyrrhopterus (Vieillot)

9♂, 8♀; Rio Lipeo, Bermejo, Villa Montes, Fortín Campero, Ele-Ele, Lagunillas.

Our specimens from as far north as the Department of Cochabamba are indistinguishable from examples from Tarija in extreme southern Bolivia.

Specimens in the Academy's collection from Descalvados, Matto Grosso, Brazil, clearly belong to *periporphyrus* (Bonaparte), not to *pyrrhopterus* as stated by Stone and Roberts (Proc. Acad. Nat. Sci. Phila., 86, 1934, p. 394).

Icterus cayanensis cayanensis (Linnaeus)

5♂, 3♀; Chatarona, Susi, Chiniñiri.

This widespread race, which has not previously been recorded from Bolivia, is apparently restricted to the Tropical Zone of the northern part of the country. The above birds resemble specimens from Cayenne (the type locality) and Pará, Brazil, but the humeral patch averages darker and the yellow of the under wing-coverts is on the average more restricted, being completely lacking in two examples from Chiniñiri. Two males from Chiniñiri have the humeral patch intermediate in color between *cayanensis* and *periporphyrus* of eastern Bolivia. One specimen (A.N.S.P. 119419) from the same locality has the tibial feathers slightly tipped with yellow.

It is important to note here that Carriker took a male and female of *I. c. periporphyrus* at Todos Santos, on the Rio Chapare, approximately 200 miles east of the Rio Kaka.

Icterus jamacaii croconotus (Wagler)

Recorded from the falls of the Rio Madeira (Auk, 1890, p. 269).

Icterus jamacaii strictifrons Todd

♂, 2♀; Chatarona, Palmarito (Chiquitos).

Brodkorb's *Icterus croconotus paraguayae* from Puerto Casado is said to differ from *strictifrons* by having a "black saddle across the interscapulum." In 11 birds from Bolivia and Matto Grosso six lack this and five have it. As a series they measure: wing ♂ 98-108, ♀ 97-104 mm.

Agelaius thilius alticola Todd

2♂; Poopó

This species has heretofore been recorded from Bolivia only from the Departments of La Paz and Cochabamba.

An adult male shows traces of pale superciliaries, these being not apparent on any of nine specimens from Peru. The second specimen from Poopó is immature.

Agelaius cyanopus Vieillot

3 ♂, 4 ♀; Chatarona.

Agelaius ruficapillus ruficapillus Vieillot

Known from the Departments of Santa Cruz and Tarija in eastern and southern Bolivia.

Amblyramphus holosericeus (Scopoli)

4 ♂, 2 ♀; Chatarona.

Gnorimopsar chopi megistus (Leverkühn)

2 ♂, 2 ♀; Chatarona.

Our specimens indicate that the Bolivian race is valid since they are decidedly smaller than birds from northeast Brazil (*sulcirostris*). The two males have a wing measurement of 133, the females of 131.5, 132.5 mm.

Oreopsar bolivianus Sclater*Ibis*, 3, no. 1, 1939, p. 144 (Sucre, Bolivia).

3 ♂, ♀; Ele-Ele.

An interesting discovery, formerly confused with *Gnorimopsar chopi*, which it superficially resembles. The genus appears to be confined to the highlands of Bolivia.

Leistes militaris superciliaris (Bonaparte)

2 ♂, 7 ♀; Cochabamba, Incachaca, Buenavista, Rio Surutú, Rio Lipeo, San Lorenzo.

Dolichonyx oryzivorus (Linnaeus)

Specimens of this North American species are recorded from Bolivia in the Catalogue of Birds of the British Museum (vol. 11, p. 332, 1886). Also recorded by Grant from Alto Paraguay, Bolivia, October 15 (*Ibis*, 1911, p. 105).

Family **PLOCEIDAE** (Weaver Finches)**Passer domesticus domesticus** (Linnaeus)

5 ♂, ♀; Villa Montes, Bermejo, Fortín Campero, Oploca.

New to Bolivia. We cannot ascertain the date when the English Sparrow first appeared in this republic.

Family **CATAMBLYRHYNCHIDAE** (Plush-capped Finches)**Catamblyrhynchus diadema citrinifrons** Berlepsch and Stolzmann

3 ♂, 3 ♀; Incachaca, Hichuloma.

Immature birds (= *C. d. pallida* Carriker) have the chestnut of the under parts rather paler.

Family **FRINGILLIDAE** (Finches)

Saltator maximus maximus (P. L. S. Müller)

5 ♂, 7 ♀; Palmar, Todos Santos, mouth of the Rio Chapare, Chiniñi, Calabate, Huanay.

Saltator similis similis Lafresnaye and d'Orbigny

Recorded from eastern Bolivia (San José and Chiquitos).

Saltator coerulescens azarae d'Orbigny

♂, 2 ♀; Chiniñi.

Saltator coerulescens coerulescens Vieillot

7 ♂, 6 ♀; Bermejo, Lagunillas, Villa Montes, Fortín Campero, Chiquitos.

Saltator aurantirostris aurantirostris Vieillot

2 ♂, 2 ♀; Villa Montes, Rio Lipeo.

Saltator aurantirostris tilcarae Chapman

3 ♂, ♀; Entre Rios, Fortín Campero.

We refer our Tarija specimens, taken below 5,000 ft., to this Argentine race, except those from Villa Montes and the Rio Lipeo which lack the white on the rectrices.

Saltator aurantirostris hellmayri Bond and de Schauensee

Not. Naturae, no. 12, 1939, p. 2; Not. Naturae, no. 44, 1940, p. 4 (Tiraque, Dept. Cochabamba, Bolivia).

30 ♂, 12 ♀, 2 o; La Paz, Chorros, Tiraque, Tanapacá, Tutimayo, Incachaca, Ele-Ele, Tomina, Oploca, La Merced, Lagunillas, San Lorenzo.

This form, previously known as *bolivianus* Chapman, required, as had been pointed out by Hellmayr, a new name. It differs from the related *tilcarae* in having much more white on the inner web of the outer rectrix, this white area, according to Chapman, measuring from 22 to 28 mm., whereas in *hellmayri* this area measures from 32 to 53 mm. The Tarija specimens are more or less intermediate *hellmayri* × *tilcarae*.

Saltator atricollis Vieillot

3 ♂, 2 ♀; Rio Quiser, north Chiquitos (2500 ft.), Chiquitos.

Saltator rufiventris Lafresnaye and d'Orbigny

2 ♂, 2 ♀; Tiraque, Tutimayo.

There are three other specimens without data of this interesting *Saltator* in the collection of the Academy. The species is endemic to Bolivia.

Pitylus grossus grossus (Linnaeus)

♂; Santa Ana.

***Paroaria coronata* (Miller)**

5 ♂, 3 ♀; Villa Montes.

The wings of these Bolivian specimens are no shorter than a series from Descalvados, Brazil, and one bird from Argentina. The bills of the Bolivian specimens average somewhat smaller than those from Descalvados, the former measuring 12-13 mm., as against 13-15 mm. There is no color difference.

***Paroaria gularis cervicalis* Sclater**

2 ♂, 2 ♀; Yapacani (Santa Cruz), Cercado (Santa Cruz), Todos Santos.

***Paroaria capitata fuscipes* Bond and de Schauensee**

Not. Naturae, no. 12, 1939, p. 2 (Fortín Campero, 1150 ft., Dept. Tarija, Bolivia).

3 ♂, 5 ♀; Fortín Campero.

Similar in color to *P. capitata* but with smaller bill and with feet and tarsi brownish instead of orange-yellow. These are apparently the only specimens of this species that have been taken in Bolivia.

***Pheucticus aureo-ventris aureo-ventris* (Lafresnaye and d'Orbigny)**

12 ♂, 6 ♀, 2 o; Villa Montes, Rio Lipeo, La Merced, Incachaca, San Cristobal, Ele-Ele, Chorro, Tomina, Teoponte, Santa Ana.

***Cyanocompsa cyanoides rothschildii* (Bartlett)**

♂, 2 ♀; Todos Santos, Teoponte, Chiniñi.

We are unable to distinguish *C. c. peruvianus* Carriker from specimens from Cayenne and northeast Brazil.

***Cyanocompsa cyanea argentina* (Sharpe)**

23 ♂, 8 ♀; Rio Azero, Rio Lipeo, Lagunillas, Entre Rios, Ele-Ele, Samaipata, Villa Montes, Bermejo, Fortín Campero.

***Porphyrospiza caerulescens* (Wied)**

Recorded from the Department of Chuquisaca.

***Spermophila schistacea* subsp.**

A single specimen recorded from Juntas at the northern base of the Cordillera of Cochabamba, apparently differs from *S. s. longipennis* (Chubb), according to Hellmayr.

***Spermophila plumbea plumbea* (Wied)**

Known from eastern Bolivia (Chiquitos).

***Spermophila leucoptera bicolor* (Lafresnaye and d'Orbigny)**

♂; Chatarona.

***Spermophila obscura obscura* (Lafresnaye and d'Orbigny)**

3 ♀; Huanay.

Spermophila collaris ochrascens (Hellmayr)

Sporophila melanocephala pallida Carriker, Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 339 (Chatarona, Dept. Beni, Bolivia).

2 ♂, 2 ♀; Chatarona (600 ft.).

We have compared three males from Chatarona, including the type of *pallida*, with an adult male from Descalvados and are unable to distinguish Carriker's race. In any case the name *pallida* is preoccupied.

Spermophila luctuosa Lafresnaye

9 ♂, 3 ♀; Todos Santos, Chiniñi, Samaipata, Santa Ana.

Spermophila caerulescens caerulescens (Vieillot)

Birds from eastern Bolivia are probably referable to this race.

Spermophila caerulescens yungae (Gyldenstolpe)

Arkiv för Zool., 33 B, no. 13, 1941, p. 3 (Chulumani, Dept. La Paz, Bolivia).

5 ♂; Chatarona, Huanay, Susi.

Spermophila lineola (Linnaeus)

Recorded from eastern Bolivia.

Spermophila minuta hypoxantha (Cabanis)

Recorded from eastern Bolivia.

Spermophila ruficollis (Cabanis)

Recorded from eastern Bolivia.

Spermophila nigro-rufa (Lafresnaye and d'Orbigny)

Recorded from eastern Bolivia (Chiquitos).

Spermophila hypochroma (Todd)

♂; Buenavista.

Spermophila castaneiventris (Cabanis)

3 ♂; Todos Santos, Palmar, Chiniñi.

Catamenia analis subinsignis Carriker

Proc. Acad. Nat. Sci. Phila., 87, 1935, p. 340 (Sandillani, Yungas of La Paz, Bolivia).

5 ♂, 3 ♀; Sandillani, Calacoto.

Dr. Hellmayr surmised that this form was not valid and was synonymous with the nominate race. The bird is quite recognizable, being most closely related to the Peruvian *insignis*, for both lack the prominent white speculum of *analis*. It differs from the latter in having but a trace of the white speculum and being uniform gray below, not showing the albescent abdomen of *analis*. From *insignis*, the present race differs in being darker below and the white tail-band is narrower. Wing, ♂ 70-72.5; ♀ 65-67 mm.

Although the type localities of *analis* and *subinsignis* are close together their ranges are separated by the divide above La Paz, *subinsignis* being found on the north slope.

Catamenia analis analis (Lafresnaye and d'Orbigny)

34 ♂, 17 ♀; La Paz, Incachaca, Entre Rios, La Merced, Padilla, Tutimayo, Samaipata, Oploca, Ele-Ele, Tiraque, Tanapacá, Tomina, Chorros, San Lorenzo, Lagunillas, Hichuloma.

Catamenia inornata inornata (Lafresnaye)

5 ♂, 5 ♀; Tiraque, above Tutimayo, Callipampa, Pongo, Hichuloma.

Lafresnaye's type, an immature bird, is in the collection of the Academy.

Catamenia homochroa homochroa Sclater

♂, ♀; Incachaca.

Oryzoborus crassirostris gigantirostris Bond and de Schauensee

Oryzoborus atrirostris gigantirostris Bond and de Schauensee, Not. Naturae, no. 12, 1939, p. 3 (Chatarona, Dept. Beni, Bolivia).

♂, ♀; Chatarona (600 ft.), Dept. Beni.

A very distinct form, characterized chiefly by its extraordinarily heavy bill. We believe *O. atrirostris* Sclater and Salvin of Moyobamba, Peru, to be conspecific with *crassirostris*. The Academy has three topotypes of *atrirostris*, two males and one female.

Oryzoborus angolensis angolensis (Linnaeus)

♂, ♀, ♂ juv., o; Chatarona.

We list these birds under the nominate race, but consider them indistinguishable from a series of "*torridus*" from Trinidad, Pará (Brazil), and Moyobamba (Peru). There is considerable individual variation in the tone of the chestnut of the under parts of the adult male in specimens from the same locality.

Volatinia jacarina jacarina (Linnaeus)

4 ♂, ♀; Rio Azero, Santa Ana.

Spinus crassirostris (Landbeck)

9 ♂, 5 ♀; Finca Salo.

New to Bolivia. Compared with specimens from Chile with which they agree.

Spinus magellanicus bolivianus (Sharpe)

32 ♂, 14 ♀; Tutimayo, Tiraque, Chorros, Oploca, Callipampa, Tomina, Padilla, San Lorenzo, Tarija-Villa Montes Road (7000 ft.).

The adult males (22) have wing measurements of 71-78 mm. All these specimens were taken at high altitudes (7,000-13,000 ft.).

Spinus magellanicus santae-crucis Todd

4 ♂, 3 ♀; Samaipata (5500 ft.).

These birds are intermediate in size between *bolivianus* and *alleni*. The wings of the four males measure 68, 69.5, 70, 73 mm. respectively. We do

not believe that two species, *magellanicus* and *santae-crucis*, are found at Samaipata, since the largest specimen from this locality agrees in size with specimens of *bolivianus*, but has the dorsal feathers extensively blackish in the centers, characteristic of *santae-crucis*. The latter can be distinguished from *bolivianus* in series by smaller size and blacker centers to the feathers of the mantle in adult males. Females average decidedly smaller (wing 66.5-69 mm.).

***Spinus magellanicus alleni* Ridgway**

4 ♂, 4 ♀; Villa Montes, Tomina, Entre Rios.

We refer all our birds taken below 7,000 feet to *alleni*, except those taken at Samaipata. The present form is similar in coloration to *bolivianus* but is decidedly smaller. Wing measurements of the males (all adults) are 67, 67.5, 68, 69, of the females 64.5 (3), 65.5.

***Spinus olivaceus* Berlepsch and Stolzmann**

3 ♂, 4 ♀; Incachaca, Sandillani, Calabatea.

***Spinus xanthogaster stejnegeri* (Sharpe)**

14 ♂, 5 ♀; La Paz, below Viloca, Calacoto, Samaipata, Sandillani, Calabatea.

***Spinus atratus* (Lafresnaye and d'Orbigny)**

12 ♂, 14 ♀; "La Paz", Calacoto, Callipampa, Kari-Kari Mts., Cerdas, Oploca, Viloca.

We agree with Hellmayr (Cat. Bds. Amer., 13, pt. 11, p. 292, footnote) that *S. a. fasciatus* Carriker is untenable. The type from Upamayo, Lake Junin, Peru, is an immature female.

***Spinus uropygialis* (Sclater)**

♀; Llallagua.

In the Academy's collection are also specimens from the Pampa de los Arrieros (12,350 ft.) and from Desaguadero, Titicaca, Peru. Apparently not previously recorded from Bolivia.

***Sicalis uropygialis uropygialis* (Lafresnaye and d'Orbigny)**

22 ♂, 10 ♀; Cataví, Viloca, Llallagua, Callipampa, La Cumbre, Chocaya, Tiraque, Kari-Kari Mts., Uyuni.

***Sicalis luteo-cephala* (Lafresnaye and d'Orbigny)**

11 ♂, 3 ♀; Oploca, Tiraque, Pocona, Tutimayo.

Not hitherto recorded from the Department of Potosí.

***Sicalis lutea* (Lafresnaye and d'Orbigny)**

13 ♂, 15 ♀; Callipampa, Cataví, Cerdas, Chocaya, Llica, Oploca, Pulacayo, Uyuni.

Not hitherto recorded from the Department of Potosí, having been known in Bolivia only from the Department of Oruro.

Sicalis olivascens olivascens (Lafresnaye and d'Orbigny)

25 ♂, 12 ♀, 2 o; Calacoto, La Paz, Tanapacá, Tiraque, Tutimayo, Callipampa, Cataví, Chocaya, Oploca, Potosí.

Ménégaux described *berlepschi* from Pulacayo, Dept. Oruro, as larger and brighter, differences that do not hold in the series before us. Wing measurements of males from La Paz (5) 83-88; from Cochabamba (7) 86.5-90.5; from Oruro (4) 84-90; from Potosí (9) 86.5-90.5 mm.

Sicalis flaveola pelzelni Sclater

21 ♂, 11 ♀; Santa Cruz, Bermejo, San Lorenzo, Samaipata, Buenavista, La Merced, Tutimayo, Villa Montes, Padilla, Entre Rios.

Sicalis luteola luteiventris (Meyen)

♀; Buenavista.

Diuca speculifera speculifera (Lafresnaye and d'Orbigny)

7 ♂, 6 ♀; Viloca, Cerro del Juno, La Cumbre (Yungas Railroad).

The single specimen from Yanac, Peru, described as *magnirostris* Carriker has a larger bill than 23 specimens from Bolivia and other Peruvian localities. Although we recognize this race with misgivings we feel that it should be upheld, at least until further specimens from Yanac are forthcoming.

Idiopsar brachyurus Cassin

3 ♂, 5 ♀; Viloca, km. 34 Yungas Railroad.

Phrygilus gayi punensis Ridgway

8 ♂, 2 ♀; El Pongo, Calacoto.

Phrygilus gayi atriceps (Lafresnaye and d'Orbigny)

21 ♂, 10 ♀; Tanapacá, Tiraque, Tutimayo, Callipampa, Cataví, Chocaya, Llallagua, Oploca, Potosí, Uyuni.

A nest found at Uyuni, January 30, 1938, was placed in a hole in the side of a bank. It was a loosely constructed and not very bulky cup of rootlets, lined with hair. The three eggs are greenish blue, speckled, chiefly about the larger ends, with grayish brown and lavender-gray (22.4×16.3 , 22.2×16.2 mm.; third egg broken).

Phrygilus fruticeti fruticeti (Kittlitz)

27 ♂, 12 ♀; Callipampa, below Cataví, Cerdas, Chocaya, Llallagua, Llica, Oploca, Potosí, Uyuni.

Sixteen adult males from the Departments of Oruro and Potosí have wing measurements of 97.5-107 mm.

Phrygilus fruticeti peruvianus Zimmer

10 ♂, 7 ♀; Calacoto, Tanapacá, Tiraque, Tutimayo. and above Tutimayo.

Our specimens from Tiraque and Tutimayo are from the Department of Cochabamba, whence this species has not previously been recorded. Wing measurements of four males are 96-97, of two females 94 mm., hence they evidently belong to the smaller northern race.

Differences separating the two forms of *fruticeti* are merely average both as to size, the extent of the streaking on the upper parts, and the intensity of rufous on the margins of the dorsal feathers.

Five adult males from La Paz measure 98.5-100.5, 11 from Peru 91-100.5 mm.

Phrygilus unicolor tucumanus Chapman

21 ♂, 10 ♀, 5 o; Cerro del Juno, Incachaca, Callipampa, Chocaya, Kari-Kari Mts., Llallagua, Oploca, Potosí, Pulacayo, Padilla.

Phrygilus unicolor inca Zimmer

9 ♂, 5 ♀; El Pongo, Hichuloma, La Cumbre, Viloca, Calacoto.

La Paz birds agree well with a series of *inca* from Peru. They are decidedly darker than specimens of *tucumanus*. The race *inca* has not been previously recorded definitely from Bolivia.

Phrygilus dorsalis Cabanis

9 ♂, 6 ♀; Oploca.

Two nests were found in late February, containing one and two eggs respectively. The nests are described as "bulky and deep and lined with wool and other soft material." The eggs are said to resemble those of the English Sparrow, but are larger.

Phrygilus erythronotus (Phillipi and Landbeck)

8 ♂, 8 ♀, o; Callipampa, Kari-Kari Mts., Pulacayo.

Phrygilus plebejus plebejus Tschudi

17 ♂, 9 ♀; Calacoto, Tanapacá, Tutimayo, Catavi, Chocaya, Llallagua, Oploca, Potosí, Pulacayo, Uyuni, El Pongo.

Phrygilus alaudinus excelsus Berlepsch

29 ♂, 11 ♀, 2 o; Cerro del Juno, Tiraque, Tutimayo, Vacas, Callipampa, Catavi, Llallagua, Padilla.

Not previously recorded from the Departments of Oruro and Chuquisaca.

Spodiornis rusticus rusticus (Tschudi)

3 ♂, 3 ♀; San Cristobal, San Jacinto, Incachaca, Chorro.

Lophospingus pusillus (Burmeister)

♀; San Lorenzo.

Not previously recorded from the Department of Tarija.

Lophospingus griseo-cristatus (Lafresnaye and d'Orbigny)

11 ♂, 8 ♀, o; Ele-Ele, Samaipata, Padilla, Tomina.

Coryphospingus cucullatus fargoi Brodkorb

Occ. Pap. Mus. Zool. Mich., no. 367, 1938, p. 4 (265 km. west of Puerto Casado, Paraguay).

10 ♂, 5 ♀, o; La Merced, Lagunillas, Bermejo, Entre Rios, Santa Ana, Samaipata, mouth of the Rio Chapare.

Atlapetes rufinucha rufinucha (Lafresnaye and d'Orbigny)

19 ♂, 12 ♀, o; Incachaca, Chorro, Sandillani, Hichuloma, Calabatea.

Atlapetes rufinucha carrikeri Bond and de Schauensee

Not. Naturae, no. 12, 1939, p. 5 (Samaipata, 5500 ft., Dept. Santa Cruz, Bolivia).

2 ♂, ♀; Samaipata.

A strikingly marked race, immediately distinguished from *rufinucha* in having olive-green instead of black upper parts.

Atlapetes fulviceps (Lafresnaye and d'Orbigny)

8 ♂, 10 ♀; Tomina, Padilla.

Atlapetes torquatus torquatus (Lafresnaye and d'Orbigny)

8 ♂, 4 ♀, o; Sandillani, Hichuloma, Incachaca, San Cristobal, Chorro.

Atlapetes torquatus fimbriatus (Chapman)

9 ♂, 5 ♀; Pocona, Samaipata, Padilla, Tomina.

Atlapetes torquatus borellii (Salvadori)

4 ♂, 2 ♀; Rio Azero, Rio Lipeo, Rio Bermejo.

New to the fauna of Bolivia. These birds were taken from 1350 to 4000 feet, whereas our *fimbriatus* specimens were taken from 5500 to 8200 feet.

Arremon taciturnus nigrirostris Sclater

7 ♂, 9 ♀; Santa Ana, Teoponte, Palmar, Chiniñiri.

The wing variation in these specimens is greater than that given by Hellmayr. Wings of males from Bolivia measure 69-80, the majority a trifle over 70 mm.

Arremon flavirostris devillii Des Murs

Known from the Chiquitos district.

Arremon flavirostris d'orbignii Sclater

20 ♂, 5 ♀; Ele-Ele, Samaipata, Rio Azero, Tomina, Bermejo, La Merced, Rio Lipeo, Villa Montes.

Myospiza humeralis xanthornus (Darwin)

4 ♂; Chatarona.

These birds are obviously *xanthornus* rather than *humeralis*, the submarginal rufescent edges to the dorsal feathers being much more restricted than in the nominate form. Dr. Hellmayr, in designating eastern Bolivian

birds as *humeralis*, had but a single specimen from this republic (cf. Cat. Bds. Amer., 13, 1938, p. 479).

Myospiza humeralis tarijensis Bond and de Schauensee

Not. Naturae, no. 12, 1939, p. 5 (Entre Rios, Dept. Tarija, Bolivia).

9 ♂, 3 ♀; Lagunillas, Samaipata, Entre Rios.

Myospiza aurifrons aurifrons (Spix)

8 ♂, 8 ♀; Chifiriri, Palmar, Santa Ana, Todos Santos.

Zonotrichia capensis carabayae Chapman

Bull. Amer. Mus. Nat. Hist., 77, art. 8, 1940, p. 395 (Limbani, Carabaya, southeast Peru).

8 ♂, 5 ♀; Sandillani, Incachaca, Calabatea, Hichuloma, Chorro.

Zonotrichia capensis pulacayensis (Ménégaux)

13 ♂, 10 ♀, 0; Oploca, Callipampa, Llallagua, Cataví, Tutimayo, Tiraque, Ele-Ele, San Lorenzo.

Zonotrichia capensis matutina (Lichtenstein)

Recorded by Chapman from "North Chiquitos" and "Palmaritos."

Zonotrichia capensis hypoleuca (Todd)

14 ♂, 8 ♀, 2 0; Lagunillas, Samaipata, Padilla, Tomina, Bermejo, Entre Rios, Fortín Campero, La Merced, Rio Lipeo, San Lorenzo, Yacuiba, La Paz.

Zonotrichia capensis australis (Latham)

2 ♂, 2 ♀; San Lorenzo.

These three birds, taken July 17-19, are migrants from southern South America. This form had not previously been taken in Bolivia.

Emberizoides herbicola herbicola (Vieillot)

6 ♂, 2 ♀; Chatarona, Sandillani, Samaipata.

The two birds from Samaipata and Sandillani were taken at 7500 and 6800 feet. They differ from birds taken at Chatarona (600 ft.) by being somewhat browner above and in having the flanks rather browner, less olive. Further specimens may show that this is a separable highland form.

Poospiza boliviana Sharpe

6 ♂, 3 ♀; La Merced, Tomina, Padilla.

Compared with specimens in the American Museum of Natural History from Pulque, Province of Sucre, Bolivia.

Poospiza hypochondria hypochondria (Lafresnaye and d'Orbigny)

15 ♂, 11 ♀, 0; Calacoto, Viloca, Chorro, Tiraque, Tutimayo, Cataví, Oploca, Padilla, La Merced.

The extent of the white on the inner webs of the tips of the external rectrices is very variable, in a specimen from Cochabamba this measuring only 25 mm. in length.

Poospiza torquata torquata (Lafresnaye and d'Orbigny)

11 ♂, 7 ♀, 0; Ele-Ele, San Cristobal, Samaipata, Padilla, Tomina.

We see no reason why Dr. Hellmayr has maintained *hispaniolensis* of Ecuador and Peru as a separate species.

Poospiza torquata pectoralis Todd

2 ♂, 2 ♀; Bermejo, Fortín Campero, Villa Montes.

A Tropical Zone form, not taken above 2000 feet.

Poospiza melancleuca (Lafresnaye and d'Orbigny)

13 ♂, 7 ♀; Ele-Ele, Chiquitos, Samaipata, Tomina, Bermejo, La Merced, Rio Lipeo, San Lorenzo.

Compared with specimens in the American Museum of Natural History from California, and Chilon, Dept. Santa Cruz, Bolivia.

Poospiza nigro-rufa whitii Sclater

16 ♂, 5 ♀, 0; Samaipata, Padilla, above Rio Azero, Tomina, Entre Rios, La Merced, San Lorenzo.

Poospiza nigro-rufa wagneri Sztolcman

Known only from Chulumani in the Subtropical Zone of La Paz.

Poospiza erythrophrys erythrophrys Sclater

2 ♂; La Merced.

These specimens agree with Argentine examples.

Poospiza erythrophrys cochabambae Gyldenstolpe

Arkiv. för Zool., 33 B, no. 13, 1941, p. 3 (Liriuni, Monte Tunari, 3136 m., Dept. Cochabamba, Bolivia).

5 ♂, 2 ♀; Padilla, 25 km. east of Padilla, Tomina.

Our Chuquisaca birds are obviously referable to this recently described race, which has the mantle and rump decidedly grayer, less olive-brown than the nominate form. We have seen a male from Tujma, Prov. Cochabamba, Bolivia, in the collection of the American Museum.

A nest that contained one fresh egg was found December 31, 1937, near Padilla (7600 ft.). It was situated four and a half feet above the ground on the slope of a ravine and is a bulky cup, composed of grass and moss with a soft lining of grass stems. The egg is bluish white, rather sparsely spotted with black with a few underlying markings of violet-gray, these markings chiefly confined to the larger end (18.4×13.8 mm.).

Compsospiza garleppi Berlepsch

7 ♂, 7 ♀; Tiraque.

Saltatricula multicolor (Burmeister)

5 ♂, 3 ♀; Villa Montes.

Embernagra platensis olivascens d'Orbigny

9 ♂, 10 ♀; Incachaca, Tiraque, Tutimayo, Padilla, La Merced, San Lorenzo.

ABSTRACT OF MINUTES OF THE PROCEEDINGS OF
THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

FEBRUARY 17, 1942

Annual meeting of the Academy.

One hundred sixty-eight members and guests present.

President, Charles M. B. Cadwalader, in the Chair.

Annual report for the year 1941 was presented by the President. This report covered the work of all the scientific departments, as well as the Library, Educational, Museum Exhibits, and Photographic Departments.

The Treasurer also made a report covering the finances of the institution.

During the year a total of 249 new members were elected to the Academy in the following classes: Life, 3; Contributing, 2; Annual, 222; Non-Resident, 1; Junior, 21.

Changes in membership since the last report was presented are as follows: Junior to Annual, 2; Contributing to Annual, 2; Annual to Life, 1; Annual to Sustaining, 1; Life to Associate Sustaining, 2; Life to Sustaining, 1.

During the year 1941 the Academy lost 75 members by death.

Following their nomination as prescribed by the By-Laws of the Academy, the following individuals were elected members of the Board of Trustees for the period extending to the Annual Meeting, 1945: R. R. M. Carpenter, G. Dawson Coleman, James E. Gowen, Frank J. Myers, Granville Toogood, George Vanderbilt.

ELECTION OF OFFICERS

At a meeting of the Board of Trustees of the Academy held March 16, 1942, the following officers were elected:

President: Charles M. B. Cadwalader

Managing Director: Charles M. B. Cadwalader

Vice President: Edwin G. Conklin

Vice President: R. Meyer de Schauensee

Treasurer: Arthur E. Newbold, Jr.

Assistant Treasurer: John E. Bowers

Secretary: John E. Bowers

Corresponding Secretary: James A. G. Rehn

INDEX TO THE GENERA AND SPECIES DESCRIBED AND REFERRED TO

New Species and Genera are Indicated by Bold Face Numerals

- abelii, Pongo, 133
abseconi, Donas, **197**
abstrusa, Cephalodella, 257
Acanthodesia, 179
acelinis, Diplodonta, 191
acetabulum, Dosinia, 194
acraeus, Callosciurus, **138**
Acrochordopus, 355
Acrochorda, 160
acronycha, Lecane, 263
Acteocina, 221
Acteon, 221
actices, Monommata, 266
acuflavidus, Thalasseus, 95
aculeata, Cardita, 190
Dissotrocha, 273
acuminata, Lepadella, 265
Notholca, 266
acus, Lecane, 263
acutipennis, Pseudocolop-
teryx, 351
Adineta, 273
adriatica, Colurella, 259
aemulus, Hylophilus, 367
aequatorialis, Anairetes, 351
aequistriata, Turritella, 204
affinis, Asthenes, 333
Nyroca, 105
Agelaius, 103, 380
agilis, Ascomorpha, 257
Lecane, 263
Agriornis, 339
ahlstromi, Cephalodella, 257
Ailurin, 125
akroboles, Cephalodella, 257
Lepadella, 265
alata, Euchlanis, 261
Lepadella, 265
alaudina, Coryphistera, 329
Albertia, 257
albicauda, Agriornis, 339
albiceps, Craniolca, 332
Elaenia, 353
albicollis, Eucometis, 377
Sclerurus, 336
albiculus, Callosciurus, **139**
albidiventer, Leptopogon,
355
albifrons, Muscisaxicola, 340
albigula, Grallaria, 327
albigularis, Glyphorhynchus,
338
albilora, Muscisaxicola, 340
albirostris, Archiplanus, 379
albiventer, Fluvicola, 343
Iridoprocne, 366
albiventer, Cinclodes, 329
Myiornis, 350
albivertex, Elaenia, 353
alvocinereus, Sirystes, 344
albo-vittatus, Donacobius,
362
alcimus, Diceranophorus, 260
Alectrurus, 343
alfredi, Xanthornus, 379
algicola, Collothea, 259
alleni, Spinus, 385
Alopocheilidon, 365
alternata, Cancellaria, 216
alticola, Agelaius, 380
Tachuris, 351
altila, Pleurotrocha, 267
altiloquus, Vireo, 100
altitudinis, Callosciurus, 134
amabilis, Habia, 376
amazona, Pipromorpha, 355
amazonicus, Thamnophilus,
321
amazonus, Pachyramphus,
358
amaurocephalus, Leptopo-
gon, 355
amaurochalinus, Turdus, 363
ambigua, Collothea, 259
Amblycercus, 379
Amblyramphus, 381
americana, Ascomorpha, 257
Lepadella, 265
Mareca, 105
amphiceros, Brachionus, 257
ampula, Habrotricha, 273
amydra, Leda, 180
Anabacantha, 335
Anairetes, 351
analís, Catamenia, 385
Formicarius, 326
Anas, 104, 105
anceps, Resticula, 269
andaeola, Upucerthia, 329
andaeola, Agriornis, 339
Petrochelidon, 365
angolensis, Oryzoborus, 385
angularis, Brachionus, 257
angulata, Testudinella, 270
angusticollis, Habrotricha,
273
angustirostris, Lepidoco-
laptés, 337
Phylloscartes, 351
Phytotoma, 359
Anhinga, 90
Anisognathus, 374
annetea, Lindia, 266
annulus, Taphrocampa, 270
anodonta, Colurella, 259
Phacoides, 192
Anomia, 187
anthadis, Eosphora, 261
anthracinus, Knipolegus, 343
Turdus, 363
Anthus, 366
Antigona, 194
antillarum, Buteo, 91
Zonotrichia, 103
Anuraeopsis, 257
aper, Aspelta, 257
aperta, Calyptraea, 207
apiculata, Chaetopleura, 202
apocolea, Cephalodella, 257
apsicora, Cephalodella, 257
Lepadella, 265
apsida, Lepadella, 265
aquila, Lecane, 263
arata, Cardita, 190
Arawakella, 60
Arca, 181
Archilochus, 105
Archiplanus, 379
Arctietis, 123
Arctonyx, 121
arcuata, Pipreola, 357
arcula, Lecane, 263
ardens, Piranga, 376
ardesiaca, Conopophaga, 319
arequipae, Asthenes, 333
argentina, Batara, 320
Cyanocompsa, 383
Melanopareia, 324
argentinus, Chlorospingus,
378
Empidonax, 347
argus, Eothinia, 261
argyrogenges, Calliste, 374
ariprepes, Sinantherina, 270
armiger, Testudinella, 270,
281
aroyae, Thamnophilus, 321
Arremon, 389
artamus, Diceranophorus, 260
Arundinicola, 343
asarcia, Cephalodella, 257,
275

- Ascomorpha, 257
 asiatica, Zenaida, 104
 Asio, 105
 Aspelta, 257
 asper, Rattus, 158
 aspersiventer, Thamnophilus, 322
 aspinia, Keratella, 262
 aspis, Testudinella, 270
 Asplanchna, 257
 Asplanchnopus, 257
 assimilis, Agelaius, 103
 Furnarius, 328
 Astarte, 188, 189
 Asthenes, 333
 astia, Monommata, 266
 Astrangia, 178
 atacamensis, Cincloides, 329
 atchinus, Rattus, 152
 Ateleodacnis, 369
 aterrimus, Knipolegus, 343
 Atlapetes, 389
 atratus, Coragyps, 90
 Spinus, 386
 atricapillus, Herpsilochmus, 324
 atricollis, Saltator, 382
 atriceps, Myiarchus, 346
 Phrygilus, 387
 atirostris, Dendrocincla, 339
 atrocaerulea, Calliste, 373
 atrosericeus, Ramphocelus, 375
 atro-virens, Xanthornus, 379
 Atticora, 365
 Attila, 357
 audax, Platypsaris, 359
 audubonii, Polyborus, 91
 aurantioirostris, Saltator, 382
 aurantio-atro-cristatus, Empidonomus, 344
 aureata, Tanagra, 371
 aureo-ventris, Pheucticus, 383
 auriceps, Myiophobus, 347
 auricularis, Grallaria, 328
 auriculata, Cephalodella, 257
 aurifrons, Myospiza, 390
 aurita, Itura, 262
 Notommata, 266
 australis, Amblycercus, 379
 Myiarchus, 346
 Myrmotherula, 323
 Synallaxis, 331
 Tolmomyias, 348
 Zonotrichia, 390
 Automolus, 335
 axillaris, Myrtherula, 323
 azarae, Saltator, 382
 Synallaxis, 331
 babad, Dendroica, 101
 bahamensis, Anas, 104
 Balanus, 223
 balli, Eumorsea, 8
 bangsi, Xiphorhynchus, 337
 barang, Lutra, 120
 barbadensis, Loxigilla, 103
 barbata, Adineta, 273
 Ptygura, 269
 barussanus, Rattus, 156
 Basileuterus, 370
 bassana, Moris, 105
 Batara, 320
 batus, Rattus, 159
 beatum, Trigonostoma, 217
 Beauchampia, 257
 beauchampia, Ptygura, 269
 belone, Cephalodella, 257
 beltista, Aspelta, 257
 bemata, Proales, 268
 beni, Temnomastax, 14
 beniensis, Cnemotriccus, 347
 benii, Tyrannulus, 355
 benjamini, Lepadella, 265
 bennetchi, Notommata, 266, 277
 berlepschi, Asthenes, 333
 Calliste, 373
 Grallaria, 327
 Leptasthenura, 330
 Ochthoeca, 342
 Polioptila, 364
 Turdus, 362
 biastis, Dicanophorus, 260
 bicolor, Microrhopis, 324
 Spermophila, 383
 bicristata, Trichocerca, 271
 bicuspes, Trichocerca, 271
 bicuspidata, Colurella, 259
 bidens, Trichocerca, 271
 bidentata, Nassarius, 215
 Testudinella, 271
 bifurca, Lecane, 263
 Squatinella, 270
 bilineata, Saxicava, 201
 bimaaculatus, Cnemotriccus, 347
 biplicata, Metis, 196
 bitorquata, Melanopareia, 323
 bivittatus, Basileuterus, 370
 Lepidocolaptes, 338
 blangorum, Rattus, 145
 bocki, Callosciurus, 137
 bogotensis, Anthus, 367
 boliviae, Cistothorus, 360
 boliviana, Calliste, 373
 Chamaeza, 326
 Chiroxiphia, 356
 Chlorornis, 378
 Grallaricula, 327
 Henicorhina, 361
 Iridosornis, 374
 Phibalura, 357
 Poospiza, 390
 Ramphotrigon, 349
 Thraupis, 375
 Yanacea, 351
 bolivianum, Campptostoma, 354
 bolivianus, Attila, 357
 Basileuterus, 371
 Chlorospingus, 378
 Cnemarchus, 341
 Empidonax, 346
 Lepidocolaptes, 337
 Molothrus, 379
 Myioborus, 370
 Oreopsar, 381
 Phylidor, 335
 Piprites, 356
 Pitangus, 345
 Scytalopus, 319
 Snaragdolanus, 367
 Spinus, 385
 Thryothorus, 361
 Tyranniscus, 354
 boliviensis, Lamprospars, 379
 bonariensis, Molothrus, 379
 Thraupis, 375
 borealis, Lepadella, 265
 borellii, Atlapetes, 389
 Temnomastax, 26
 bostoniensis, Kellicottia, 263
 brachiata, Filinia, 262
 Ptygura, 269
 Brachionus, 257
 brachydactyla, Lecane, 263
 brachyotis, Cynopterus, 115
 brachyrhynchus, Contopus, 346
 brachyura, Myrmotherula, 322
 Trichocerca, 271
 brachyurus, Idiopsar, 387
 bractea, Lepadella, 265
 brazilensis, Tityra, 359
 brevisrostris, Anthus, 366
 Sublegatus, 354
 Xiphorhynchus, 337
 brevispina, Mytalina, 226
 brevita, Lecane, 263, 280
 brevinguis, Dendroica, 105
 brunneifrons, Terenotriccus, 347
 brunneiventris, Diglossa, 368
 brunnescens, Buteo, 91
 bruniceps, Myioborus, 370
 brycei, Pleuretra, 274
 Bryceella, 257
 budytoides, Stigmatura, 352
 bulla, Lecane, 263
 Bulliopsis, 215
 burmeisteri, Acrochordopus, 355
 burnsi, Muricea, 212
 Semele, 199
 Busycon, 214
 Buteo, 91

- Buthraupis, 374
 Butorides, 105
 cabanisi, Knipolegus, 343
 Syndactyla, 335
 Cacicus, 379
 caduloide, Dentalium, 222
 Cadulus, 222
 cadwaladeri, Laniisoma, 356
 Thamnophilus, 320
 caeca, Testudinella, 270
 caearensis, Cycularhis, 368
 caerulescens, Chlorophanes, 369
 Porphyrospiza, 383
 Spermophila, 384
 calamae, Tolmomyias, 348
 californica, Morsea, 8
 caligo, Eumastacops, 84
 Callichelidon, 105
 Calliostoma, 203
 Calliste, 372
 Callosciurus, 134
 calophrys, Hemispingus, 378
 calpidia, Dapidia, 260
 calvertensis, Terebra, 220
 Calyptraea, 207
 camaguei, Masynes, 35
 campanulata, Collothea, 259
 campestris, Parasphena, 293
 campicola, Coryphistera, 329
 campplanata, Pompholyx, 268
 Camptostoma, 354
 Campylorhamphus, 338
 Cancellaria, 216
 canicauda, Grallaria, 327
 caniceps, Myiopagis, 353
 canora, Tiaris, 103
 capillifera, Tellina, 200
 capistrata, Muscisaxicola, 340
 Caprimulgus, 105
 Capsiempis, 351
 capucina, Trichocerca, 271
 capucinus, Dicanophorus, 260
 carabayae, Pseudocolaptes, 334
 Synallaxis, 331
 Zonotrichia, 390
 carbonaria, Diglossa, 368
 Cardita, 190
 Cardium, 193
 carlini, Enicentrum, 261
 carolina, Porzana, 105
 carolinensis, Zenaida, 105
 carrikeri, Atlapetes, 389
 Casiornis, 357
 castanea, Dendroica, 105
 castaneicollis, Hemispingus, 378
 castaneiventris, Spermophila, 384
 casteneoventris, Delothraupis, 374
 castaneus, Niphocolaptes, 336
 casula, Cymatosyrinx, 218
 catamarcae, Anthus, 366
 Catamblyrhynchus, 381
 Catamenia, 384
 catesbyi, Phaethon, 90
 catharinae, Caliste, 373
 Catharus, 364
 caudata, Drymophila, 325
 Trichotria, 273
 caudacuta, Culicivora, 351
 caudatus, Proalinopsis, 269
 cavia, Trichocerca, 271
 cayana, Cotinga, 357
 Tityra, 359
 cayanensis, Icterus, 380
 Myiozetetes, 345
 cela, Cacicus, 379
 centenaria, Arca, 182
 cenetralis, Hemithraupis, 377
 Cephalodella, 257
 Cephalopterus, 359
 ceratophylli, Limnias, 265
 cerebrus, Notommata, 266
 Cercomacra, 325
 Certhidea, 206
 Certhiaxis, 332
 certhiola, Synallaxis, 332
 cernuus, Dicanophorus, 260
 cerulea, Dendroica, 370
 cerverei, Cyanolimnas, 92
 cervicalis, Paroaria, 383
 Chaetopteleura, 202
 Chama, 193
 chamadis, Itura, 262
 Chamaeza, 326
 Charadrius, 104
 cherada, Notommata, 266
 cherriei, Elaenia, 105
 chiguanco, Turdus, 363
 chilensis, Calliste, 372
 Elaenia, 353
 chiquitos, Temnomastax, 25
 Chirocylla, 358
 Chiroxiphia, 356
 chivi, Vireo, 367
 chlaena, Mikrocodides, 266
 Chlorochrysa, 372
 chloromeros, Pipra, 356
 chloronota, Pipromorpha, 355
 chloronotus, Tyrannus, 98
 Chlorophanes, 369
 Chlorophonia, 371
 chloropus, Gallinula, 92
 Chlorornis, 378
 Chlorospingus, 378
 Chlorothraupis, 376
 Chondrohierax, 90
 chorista, Aspelta, 257, 275
 Chromogaster, 259
 chrysocephalus, Myiodynastes, 345
 chrysonotus, Archiplanus, 379
 chrysopasta, Tanagra, 372
 chrysops, Cyanocorax, 359
 chrysoptera, Vermivora, 105
 chrysotis, Calliste, 373
 Cichlherminia, 100
 Cinelodes, 329
 Cinclus, 360
 cincta, Dichrozona, 323
 cinereus, Lipaugus, 358
 cinerascens, Camptostoma, 354
 cinerea, Muscisaxicola, 341
 Serpophaga, 352
 Nolmis, 339
 cinereum, Conirostrum, 369
 cinnamoinea, Pyrrhomyias, 347
 Cinnycerthia, 360
 circinator, Aspelta, 257
 Circus, 105
 Cissopsis, 378
 Cistothorus, 360
 citrea, Protonotaria, 105
 citrina, Philodina, 274
 Wilsonia, 105
 citrinifrons, Catamblyrhynchus, 381
 clara, Lecane, 263
 clastopis, Erignatha, 261
 clathrodon, Mactra, 197
 clavigera, Taphrocampa, 270
 clavulus, Seila, 206
 clavus, Microcodin, 266
 Clementia, 194
 climacois, Lecane, 263
 clostercera, Lecane, 263
 clypeata, Spatula, 105
 Cnemarchus, 341
 Cnemotricus, 347
 cochabambae, Grallaria, 327
 Poospiza, 391
 Thamnophilus, 322
 cochlearis, Keratella, 262
 codonella, Notommata, 266
 Coereba, 369
 coeruleescens, Saltator, 382
 cognita, Proales, 268
 colastes, Dicanophorus, 260
 collaris, Habrotrocha, 274
 Trichocerca, 271
 collinsi, Dendroica, 105
 Hypocnemis, 326
 collinsi, Macrochaetus, 266
 Collothea, 259

- Colinus, 91
 Colonia, 342
 colorata, Tanagra, 372
 coloreum, Todirostrum, 439
 colubris, Archilochus, 105
 Columbignallina, 95
 Colurella, 259
 commensalis, Embata, 273
 commersoni, Furnarius, 328
 compacta, Cephalodella, 257
 compressa, Cephalodella, 257
 Compsocoma, 374
 Compsospiza, 391
 Compsothlypis, 370
 conchyliophora, Xenophora, 209
 concinna, Macrotrachela, 274
 congregata, Chama, 193
 Conichiloides, 260
 conifera, Floscularia, 262
 Conirostrum, 369
 conjuncta, Cephalodella, 257
 Conochilus, 259
 Conopophaga, 319
 connectens, Thamnophilus, 321
 Xenops, 335
 conradi, Cadulus, 222
 consobrina, Asthenes, 333
 consobrinus, Automolus, 335
 constricta, Habrotrocha, 274
 Lecane, 263
 contemptus, Turdus, 362
 Contopus, 346
 contorta, Notommata, 266
 copeus, Notommata, 266
 Coragyps, 90
 Coralliophila, 213
 Corbula, 198
 corniculata, Rousseletia, 270
 coronata, Paroaria, 383
 Xolmis, 339
 coronatus, Platyrinchus, 348
 coronetta, Collothea, 259
 cornuta, Collothea, 259
 Lecane, 263
 corynetis, Collothea, 259
 Coryphistera, 329
 Coryphospingus, 389
 corystis, Dieranophorus, 260
 Corythopis, 319
 costatum, Crucibulum, 208
 Cotinga, 357
 cotta, Myiopagis, 98
 Cranioleuca, 332
 crassa, Keratella, 262
 Crassinella, 189
 crassipes, Cephalodella, 258
 crassirostris, Spinus, 385
 crenata, Lecane, 263
 crenulatus, Phaeoides, 192
 Crepidula, 208
 Creurgops, 376
 erinitus, Myiarchus, 105
 cristata, Lepadella, 265
 Presbytis, 129
 Trichocerca, 272
 croconotus, Icterus, 380
 Crucibulum, 208
 cruceiformis, Macrotrachela, 274
 crucigera, Beauchampia, 257
 crystallina, Ptygura, 269
 cryptoleuca, Progne, 98
 cuchacanchae, Asthenes, 333
 eucullatus, Icterus, 103
 Culicivora, 351
 cumberlandiana, Coralliophila, 213
 cumberlandia, Turritella, 203
 cuneiformis, Astarte, 189
 Flabellum, 179
 Cupelopagus, 260
 curvicornis, Lecane, 263
 curvilarata, Terebra, 220
 cyaneoviridis, Callichelidon, 105
 Cyanerpes, 369
 cyaneum, Conirostrum, 369
 cyanicollis, Calliste, 373
 Cyanocompsa, 383
 Cyanocorax, 359
 cyanodorsalis, Orochelidon, 365
 cyanoleuca, Pygochelidon, 365
 Cyanolimnas, 92
 Cyanolyca, 360
 cyanomelas, Cyanocorax, 360
 cyanopus, Agelaius, 381
 cyanotis, Calliste, 373
 Cycularhis, 367
 cylindrica, Trichocerca, 271
 Cymatosyrinx, 218
 Cymbalaimus, 320
 Cynopterus, 115
 Cypsnagra, 377
 cyrtopus, Notommata, 266
 Daenis, 369
 dactylatra, Sula, 90
 dactyliseta, Lepadella, 265
 dahlgreni, Asplanchnopus, 257
 dalecarlica, Dorria, 261
 dalli, Fossarus, 207
 danae, Astrangia, 178
 Dapidia, 260
 darwini, Thraupis, 375
 debilis, Turdus, 363
 declivis, Tellina, 200
 Deconychura, 338
 deflexa, Colurella, 259
 delalandi, Corythopis, 319
 delawarensis, Larus, 105
 Delothraupis, 374
 delumbis, Mactra, 196
 Dendrexetastes, 336
 Dendrocicla, 339
 Dendrocolaptes, 336
 Dendroica, 101, 105, 370
 Dendroplex, 337
 densata, Plicatula, 185
 Dentalium, 222
 dentata, Creurgops, 376
 denticaudata, Colurella, 259
 depressa, Lecane, 263
 deserticola, Psychomastax, 7
 dexeva, Siphonalia, 213
 devillei, Dendrexetastes, 336
 Drymophila, 324
 devillii, Arremon, 389
 devius, Campylorhamphus, 338
 diaphora, Monommata, 266
 diardii, Rattus, 146
 diasema, Notommata, 266
 dicella, Testudinella, 270
 Dichrozona, 323
 Dieranophorus, 260
 Didermocerus, 161
 Diglossa, 368
 dilatata, Eucharis, 262
 dinellii, Thamnophilus, 321
 Diplodonta, 191
 directus, Ensis, 200
 Disciniscia, 179
 discolor, Cranioleuca, 332
 dispar, Coereba, 369
 Dissotrocha, 273
 distans, Astarte, 188
 Druca, 387
 dolerus, Dieranophorus, 260
 doliaris, Proales, 268
 Dolichonyx, 381
 dominica, Dendroica, 102, 105
 Oxyura, 104
 domestica, Progne, 364
 domesticus, Passer, 381
 Donacobius, 362
 Donax, 197
 doneta, Notommata, 266
 d'orbignii, Arremon, 389
 d'orbignyanus, Xiphorhynchus, 337
 d'orbignyi, Asthenes, 333
 Dorria, 261
 dorsalis, Cycularhis, 368
 Mimus, 362
 Phrygilus, 388
 dorseyi, Cephalodella, 258
 Dosinia, 194
 dossuarius, Conichiloides, 260
 Drilophaga, 261
 Dryobates, 104
 Dryomphila, 324
 ducatelli, Venus, 194

- dumicola, Morseae, 8
 Poliopitila, 364
 duplicata, Polinices, 209
 Dysithamnus, 322
 dysorata, Lecane, 263, 280

 eboreum, Calliostoma, 203
 eboreus, Pecten, 186
 ecaudatus, Perissotriccus, 350
 ecaudis, Ascomorpha, 257
 ecclesiastica, Rapana, 211
 Echinarchinius, 179
 Echinorex, 109
 Ecephora, 211
 edentata, Collothea, 259
 edestes, Dieranophorus, 260
 ehrenbergi, Keratella, 262
 Macrotrachela, 274
 elachis, Lecane, 263
 Elaenia, 105, 352
 elasma, Lecane, 263
 elegans, Progne, 364
 elevata, Corbula, 198
 elongata, Cephalodella, 258
 Eothinia, 261
 Nassarius, 214
 Trichocerca, 271
 Wierzejskiella, 273
 Elosa, 261
 Emballonura, 118
 Embata, 273
 Emberizoides, 390
 Embernagra, 391
 emarginula, Testudinella, 270
 Empidonax, 346
 Empidonomus, 344
 Encentrum, 261
 enedra, Monommata, 266
 Ensis, 200
 Enteroplea, 261
 Entomodestes, 264
 Entotriccus, 343
 Eospora, 261
 Eothinia, 261
 epiccharis, Dieranophorus, 260
 epicopta, Testudinella, 270
 Epiphanes, 261
 equina, Rusa, 162
 Erato, 211
 Ereunetes, 105
 Erignatha, 261
 erythrogaster, Hirundo, 366
 erythronotus, Phrygilus, 338
 erythrophrys, Poospiza, 391
 erythrotis, Grallaria, 327
 Ervilia, 196
 Euchlanis, 261
 Eucometis, 377
 Eucrassatella, 190
 Eudactylota, 262
 eudactylotum, Eudactylota, 262
 eukolpa, Eothinia, 261
 eukosmeta, Trichotria, 273
 euleri, Empidonax, 346
 Eumastacops, 55
 Eumorsea, 8
 eunoma, Cephalodella, 258
 euophrys, Basileuterus, 370
 euryptera, Polyarthra, 268
 eurysterna, Lepadella, 265, 279
 Euscarthmornis, 349
 Euscarthmus, 351
 eva, Cephalodella, 258
 excelsus, Phrygilus, 388
 excubitor, Bataria, 320
 exigua, Cephalodella, 258
 Columbigallina, 95
 exitus, Masyntes, 53
 facinus, Dieranophorus, 260
 Falco, 106
 fallaciosa, Proales, 268
 fargoi, Coryphospingus, 389
 fasciata, Atticora, 365
 Geositta, 328
 Neothraupis, 378
 fascicularis, Macaca, 126
 fasciicauda, Pipra, 356
 fasciola, Notommata, 266
 Fasciolaria, 216
 Felis, 124
 felis, Encentrum, 261
 ferocior, Myiarchus, 346
 ferrugineiventris, Coniostomum, 369
 Filinia, 262
 fimbriatus, Atlaptes, 389
 Stephanoceros, 270
 fissa, Anuraeopsis, 257
 Fissuridea, 203
 Flabellum, 179
 flammeus, Asio, 105
 flammulatus, Hemitriccus, 350
 flava, Piranga, 376
 flaveola, Capsiempis, 351
 flaveolus, Basileuterus, 370
 flavicularis, Chlorospingus, 378
 flavinucha, Compsocoma, 374
 Muscisaxicola, 340
 flaviostris, Anairetes, 351
 flaviventer, Daenis, 369
 flaviventris, Hylophilus, 367
 flavogaster, Elaenia, 352
 flavovirens, Basileuterus, 370
 flavoviridis, Vireo, 367
 flexilis, Lecane, 263
 floridana, Speotypo, 95
 Floscularia, 262
 fluviatilis, Muscisaxicola, 341
 Fluvicola, 343
 foetidus, Gymnoderus, 359
 foreipatus, Dieranophorus, 260
 forficata, Cephalodella, 258
 forficula, Cephalodella, 258
 Formicarius, 326
 Formicivora, 324
 formosa, Lecane, 263
 formosum, Pseudoploesoma, 269
 fornicata, Crepidula, 208
 fortirostris, Holoquistus, 102
 fortis, Tityra, 359
 Fossarus, 207
 foxi, Cranioloeuca, 332
 Pleurohiria, 219
 fragile, Sinum, 210
 frater, Herpsilochmus, 324
 Minus, 362
 Troglodytes, 361
 frenata, Chlorothraupis, 376
 frontalis, Muscisaxicola, 340
 Pipreola, 357
 fruticeti, Phrygilus, 387
 fulgentissima, Chlorochrysa, 372
 Fulica, 93
 fuliginiceps, Leptasthenura, 330
 fulva, Cinnycerthia, 360
 Lindia, 266
 fulviceps, Atlapetes, 389
 Rhynchocyclus, 349
 fulvicervix, Calliste, 373
 fulvularis, Chlorospingus, 378
 fulviventris, Synallaxis, 331
 fumigatus, Contopus, 346
 Turdus, 363
 furcata, Lecane, 263
 Furnarius, 328
 fusca, Phaecoprogne, 365
 fuscata, Alopocheilidon, 365
 fuscator, Turdus, 363
 fuscatus, Margarops, 105
 fuscicapillus, Lepidocolaptes, 337
 fuscicauda, Cercomacra, 325
 fusciceps, Thripophaga, 334
 fuscipectus, Synallaxis, 331
 fuscipes, Paroaria, 383
 fuscorufa, Ochthodiaeta, 341
 fusiformis, Trichocerca, 271
 gaimardii, Myiopagis, 353
 galbina, Cephalodella, 258
 galeata, Lecane, 263
 Numida, 92
 galena, Notommata, 266
 gallae, Paraspheena, 305

- Gallinula, 92
 garleppi, Compsospiza, 391
 Gastropus, 262
 Geositta, 328
 Geothlypis, 370
 gibba, Cephalodella, 258
 gibbus, Pecten, 187
 gigantirostris, Oryzoborus, 385
 gigas, Elaeinia, 353
 gilvus, Tyranniscus, 355
 glauca, Diglossa, 368
 Glaucis, 96
 glaucogularis, Dacnis, 369
 glaucops, Tyto, 95
 globata, Cephalodella, 258
 Glycymeris, 183
 Glyphorhynchus, 338
 Glyphostoma, 219
 Gnorimopsar, 381
 gonita, Lecane, 263
 gracilipes, Collothea, 259
 gracilis, Adineta, 273
 Cephalodella, 258
 Pedipartia, 267
 Proalinopsis, 269
 Trichocerca, 271
 Grallaria, 327
 Grallariola, 327
 graminicola, Cistothorus, 360
 grande, Enentum, 261
 grandis, Monommata, 266
 graniferus, Vernetus, 205
 granulata, Venericardia, 191
 granulosa, Proales, 268
 griscomi, Fissuridea, 203
 grisea, Muscixicola, 340
 Myrmotherula, 323
 griseicapillus, Sittasomus, 338
 griseigula, Myrmoborus, 326
 griseipectus, Euscarthmornis, 350
 griseo-cristatus, Lophospingus, 388
 griseus, Vireo, 100
 grossus, Pitylus, 382
 guarayanus, Thyrothorus, 361
 Gubernetes, 342
 guianensis, Rhynchocyclus, 349
 guira, Hemithraupis, 377
 gujanensis, Cyclarhis, 367
 gularis, Myiarchus, 346
 gundlachi, Dendroica, 101
 gundlachi, Masyntes, 39
 gutturala, Cranioleuca, 332
 Gymnoderus, 359
 Gymnopathys, 327
 Gymnostinops, 379
 gymnur, Echinorex, 109
 Habia, 376
 habita, Macrotrachela, 274
 Habrotricha, 273
 Habrura, 251
 Haematopus, 94
 hageni, Petimonys, 142
 haliclysta, Lecane, 263
 hamata, Lecane, 263
 hamus, Temnomastax, 18
 haplochrous, Turdus, 362
 Harringia, 262
 harterti, Schizoeaca, 331
 Upucerthia, 330
 harveyensis, Trichocerca, 272, 278
 haueriana, Dieranophorus, 260
 hauxwelli, Myrmotherula, 323
 Turdus, 363
 Helarctos, 119
 hellmayri, Anthus, 366
 Lepidocolaptes, 338
 Mecocerculus, 352
 Pyriglena, 325
 Saltator, 382
 Helmitheros, 105
 Heleodytes, 360
 Heliochera, 357
 hemicypta, Polinices, 210
 hemileucus, Myrmochanes, 326
 hemimelaena, Myrmeciza, 326
 Hemispingus, 378
 Hemitriccus, 350
 Hemithraupis, 377
 hendersoni, Porzana, 92
 Henricorhina, 361
 leptobrachiata, Collothea, 259
 herbicola, Emberizoides, 390
 heros, Polinices, 209
 Herpsilochmus, 324
 herrickii, Asplanchna, 257
 heterura, Asthenes, 333
 hilleri, Nycticebus, 126
 Himantopus, 104, 105
 hindenburgi, Colurella, 259
 hippocrepis, Conochilus, 259
 Hipposideros, 116
 hirundinacea, Cypsnagra, 377
 Hirundinea, 347
 Hirundo, 366
 hirundo, Sterna, 95
 hinlea, Cephalodella, 258
 hoactli, Nycticorax, 105
 hoevenii, Aretornyx, 121
 Holoquiscalus, 102
 holosericeus, Amblyramphus, 381
 homochroa, Catamenia, 385
 hoodii, Cephalodella, 258
 Collothea, 259
 hoogerwerfii, Rattus, 148
 hudsoni, Phaeotricus, 343
 Ploesoma, 268
 hudsonicus, Numenius, 105
 hudsonius, Circus, 105
 humilis, Callosciurus, 136
 humphreysii, Pecten, 186
 hyalina, Cephalodella, 258
 Monommata, 266
 hydrocora, Tetrasiphon, 271
 Hydropogon, 105
 Hylobates, 131
 Hylocichla, 364
 hylomyoides, Rattus, 158
 Hylomys, 109
 Hylophilus, 367
 Hylophylax, 327
 Hymenops, 343
 hyperboreus, Larus, 105
 hyperythra, Myrmeciza, 326
 hypochondria, Poospiza, 390
 hypochroma, Spermophila, 384
 Hypocnemis, 326
 Hypocnemoides, 326
 hypoleuca, Upucerthia, 329
 Zonotrichia, 390
 hypomelaena, Cercomacra, 325
 hypopyrrha, Laniocera, 357
 hypostictus, Heleodytes, 360
 hypoxantha, Spermophila, 384
 hytopus, Gastropus, 262
 icterophrys, Satrapa, 344
 Icterus, 103, 380
 Idiopsar, 387
 idonea, Arca, 182
 Corbula, 198
 igniventris, Anisognathus, 374
 ignobilis, Phaeomyias, 354
 ima, Corbula, 199
 imatongensis, Parasphena, 298
 immaculatus, Lepidocolaptes, 338
 inaequalis, Corbula, 198
 inca, Phrygilus, 388
 incisa, Eulanius, 262
 Testudinella, 270
 incurvus, Mytilus, 184
 indica, Acrocodia, 160
 inermis, Ornithion, 355
 inermis, Lecane, 263
 Trichocerca, 272
 inexpectata, Hylophylax, 327
 inflata, Modiola, 183

- inoceriformis, Clementia, 194
 inornata, Catamenia, 385
 Plicatula, 185
 Serpophaga, 352
 Terebra, 220
 inornatus, Myiophobus, 347
 inquieta, Lecane, 263
 insignis, Trichocerca, 272
 insulaemaris, Cerethidea, 206
 Mactra, 197
 insularum, Glaucis, 96
 integra, Bulliopsis, 215
 intermedia, Agriornis, 339
 Dicranophorus, 260
 Rhytipterna, 357
 Testudinella, 271
 Trichocerca, 272
 intermedium, Todiostrom, 349
 intermedius, Cymbilaimus, 320
 interrupta, Turbonilla, 206
 intrasinuata, Lecane, 264
 intrusor, Albertia, 257
 intuta, Cephalodella, 258
 inzonata, Stigmatura, 352
 iota, Volvula, 222
 Iridoprocne, 366
 Iridosornis, 374
 irupero, Xolmis, 339
 isother, Dicranophorus, 260
 Itura, 262
 jacarina, Volatinia, 385
 jacki, Tupaia, 112
 jamaicensis, Laterallus, 92
 Oxyura, 104
 janus, Floscularia, 262
 javanica, Manis, 165
 jessupi, Lecane, 264
 johnsoniana, Semele, 199
 judayi, Collotheca, 259
 Drilophaga, 261
 juninensis, Muscisaxicola, 340
 juruanus, Thryothorus, 361
 Xiphorhynchus, 337
 kapouni, Thamnophilus, 321
 Kellicottia, 263
 keniensis, Parasphena, 297
 Keratella, 262
 kinangopa, Parasphena, 290
 Knipolegus, 343
 korinchi, Rattus, 147
 Kurtziella, 219
 labri, Aspelte, 257
 lacustris, Enteroplea, 261
 laetissimus, Vireo, 367
 laevis, Mitrella, 213
 lafresnayana, Mermotheryla, 323
 lafresnayanus, Campylorhamphus, 38
 Lamprosar, 379
 lamprotis, Calliste, 373
 laniirostris, Tanagra, 372
 Laniisoma, 356
 Lanio, 376
 Laniocera, 357
 laqueatum, Cardium, 193
 Lariscus, 141
 Larus, 105
 lata, Habrotricha, 274
 Trichocerca, 272
 latens, Temnomastax, 21
 lateralis, Mulinia, 196
 Laterallus, 92
 latirostris, Sayornis, 342
 lauterborni, Lecane, 264
 leavis, Yoldia, 181
 Lecane, 263
 Leda, 180
 Legatus, 344
 Leistes, 381
 lenis, Notommata, 266
 lenticulare, Ploesoma, 268
 leontina, Lecane, 264
 Lepadella, 265
 Lepidocolaptes, 337
 lepta, Streptognatha, 270
 Leptasthenura, 330
 Leptopogon, 355
 Lessonia, 341
 lestes, Aspelte, 257
 leucocephala, Arundinicola, 343
 leucocephalus, Cinclus, 360
 leucogaster, Anhinga, 90
 Leucolepis, 362
 leucometopius, Oreopeleia, 95
 leucomystax, Paguma, 122
 leucophaius, Legatus, 344
 leucophrys, Mecocerculus, 352
 Myrmoborus, 325
 Ochthoeca, 342
 leucops, Platycichla, 364
 leucophthalma, Myrmothe-rula, 323
 leucorrhoea, Iridoprocne, 366
 leucotis, Entomodestes, 364
 leura, Lecane, 264, 281
 leveriana, Cissopsis, 378
 leydigii, Squatinella, 270
 l'herminieri, Cichlherminia, 100
 libera, Ptygura, 269
 licinia, Cephalodella, 258
 licata, Leda, 180
 lictor, Pitangus, 345
 lieftinckii, Rattus, 157
 lienosa, Area, 181
 ligona, Lecane, 264
 limicola, Rallus, 105
 Limnias, 265
 Limnotheryptis, 105
 Lindia, 266
 lineatocephalus, Xiphocolaptes, 336
 lingensis, Rattus, 155
 lineata, Dacnis, 369
 lineola, Spermophila, 384
 Lipaugus, 358
 lipera, Cephalodella, 258
 Lithophaga, 184
 littoralis, Ochthornis, 344
 I oehmias, 336
 Lophocharis, 266
 longicaudum, Scardium, 270
 longicornis, Ptygura, 269
 longipedis, Trichotria, 273, 279
 longipennis, Chlorophonia, 371
 longipes, Macrochaetus, 266
 Ptygura, 269
 Synchaeta, 270
 longiseta, Filinia, 262
 Monommata, 266
 Trichocerca, 272
 longispina, Kellicottia, 263
 Squatinella, 270
 Lophospingus, 388
 lophoessa, Trichocerca, 272
 Loxigilla, 103
 luctuosa, Spermophila, 384
 luctuosus, Tachyphonus, 376
 luctus, Rhinolophus, 116
 ludwigii, Lecane, 264
 lugens, Conirostrum, 369
 lugubris, Discinisa, 179
 luna, Lecane, 264
 lunaris, Lecane, 264
 lutea, Piranga, 376
 Sicalis, 386
 luteiventris, Sicalis, 387
 luteocephala, Sicalis, 386
 lutescens, Anthus, 366
 lütkeni, Dicranophorus, 260
 Lutra, 120
 lyoni, Cynopterus, 115
 lyra, Fossarus, 207
 lyura, Nesophlox, 97
 Macaca, 126
 macaca, Masnyntes, 41
 Machetornis, 344
 Macrocallista, 193
 Macrochaetus, 266
 macrostyla, Dissotrocha, 273
 Macrotrachela, 274
 macrura, Rotaria, 274
 Mactra, 196
 maculata, Monommata, 266

- maculatus, Catharus, 364
 maculicauda, Asthenes, 334
 Hyponemoides, 326
 maculipectus, Phacellodomus, 334
 maculirostris, Muscisaxicola, 341
 maculosus, Xanthornus, 379
 madisonius, Pecten, 185
 maerens, Rattus, 144
 major, Hipposideros, 118
 Taraba, 320
 Trichocerca, 272
 malaccensis, Pteropus, 114
 malayanus, Helaretos, 119
 Manis, 165
 marchio, Petaurista, 143
 Mareca, 105
 margaritaceiventris, Euscarthmus, 351
 Margarops, 105
 Margarornis, 334
 marginata, Plicatula, 185
 marginatus, Microcerculus, 362
 Pachyrampus, 358
 martinicensis, Troglodytes, 98
 marylandica, Arca, 182
 Astrangia, 178
 Macrocallista, 193
 Scalaria, 206
 Masyntes, 29
 matutina, Zonotrichia, 390
 maura, Pyrgilena, 325
 mauri, Ereunetes, 105
 maxi, Hylomys, 109
 maxillata, Melina, 184
 maximiliani, Melanopareia, 324
 maximilliani, Pitangus, 345
 maximus, Saltator, 382
 Mecocerculus, 352
 meddix, Masyntes, 45
 medioeris, Mitrella, 213
 megalocephala, Cephalodella, 258
 megalotrocha, Philodina, 274
 Megarhynchus, 345
 melanogaster, Formicivora, 324
 megistus, Gnorimopsar, 381
 melanaria, Cercomacra, 325
 melancholicus, Tyrannus, 344
 melanodocus, Reticula, 269
 Melanella, 205
 melanogaster, Conopophaga, 319
 melanogenys, Compsothlypis, 370
 melanoleuca, Poospiza, 391
 Melanopareia, 323
 melanops, Phleocryptes, 330
 Trichothraupis, 377
 melanopsis, Diglossa, 369
 melanoptera, Thraupis, 375
 melanura, Myrmeciza, 326
 melicerta, Linnias, 265
 Melina, 184
 melina, Eucassatella, 190
 mellea, Tanagra, 371
 meloryphus, Euscarthmus, 351
 meneta, Euchlanis, 262
 menetriesii, Mermotherula, 323
 mentalis, Catharus, 364
 mercenaria, Venus, 195
 meridionalis, Myrmotherula, 323
 Pachyrampus, 358
 metallactus, Tachyphonus, 376
 methoria, Lecane, 264
 Metis, 196
 mexicanus, Himantopus, 104, 105
 Microcerculus, 362
 Microcodin, 266
 microcornis, Trichocerca, 272
 microptera, Agriornis, 339
 Microrhopias, 324
 microrhynchus, Cyanerpes, 369
 Microspingus, 378
 militaris, Eumastacops, 73
 millsii, Stephanoceros, 270
 millvillensis, Arca, 182
 Murex, 212
 Mikrocodides, 266
 Mimus, 362
 minima, Ascomorpha, 257
 Proales, 268
 minor, Gastropus, 262
 Platysaris, 359
 Trichocerca, 272
 minuta, Lepadella, 265, 279
 Mionectes, 355
 mira, Cephalodella, 258
 Lecane, 264
 Pedalia, 267
 mitella, Lecane, 264
 mitis, Lecane, 264
 Mitrella, 213
 Mitrephanes, 347
 mixa, Keratella, 262
 mixtum, Todiostrostrum, 349
 Mnioba, 274
 moderatus, Thripadectes, 335
 modesta, Asthenes, 333
 modestus, Sublegatus, 353
 Modiola, 183
 modulator, Minus, 362
 modulatrix, Leucolepis, 362
 mollis, Trichocerca, 272
 Molothrus, 379
 Monomnata, 266
 monopus, Tylotrocha, 273
 monostyla, Lecane, 264
 montana, Agriornis, 339
 Buthraupis, 374
 Cephalodella, 258, 276
 montanus, Muntiacus, 163
 monticola, Emballonura, 118
 Moris, 105
 Morsea, 8
 moschatus, Muntiacus, 163
 musicola, Ptygura, 269
 mucosa, Cephalodella, 258
 Trichocerca, 272
 mucronata, Cephalodella, 258
 Mulina, 196
 multiceps, Asplanchnopus, 257
 multicolor, Saltatricula, 391
 multicrinis, Trichocerca, 272
 multispinosa, Macrotrachela, 274
 munda, Habrotricha, 274
 Serpophaga, 352
 Muntiacus, 163
 Murex, 212
 Muricidea, 211
 murina, Phaecomys, 354
 Nolmis, 339
 musanga, Paradoxurus, 122
 Muscisaxicola, 339
 Muscivora, 344
 musculosus, Macrotrachela, 274
 musculus, Mus, 159
 Trichocerca, 272
 Mus, 159
 Mustela, 119
 mutabilis, Collothea, 259
 mutica, Squatinella, 270
 Mya, 202
 Myadestes, 364
 myaeformis, Saxicava, 201
 myersi, Itura, 262
 Myiarchus, 105, 345
 Myiobius, 347
 Myioborus, 370
 Myiodynastes, 345
 Myiopagis, 98, 353
 Myiophobus, 347
 Myiornis, 350
 Myiotheretes, 341
 Myiozetetes, 345
 myotherinus, Myrmoborus, 326
 Myotis, 118
 Myospiza, 389
 Myrmeciza, 326

- Myrmoborus, 325
 Myrmochanes, 326
 Myrmorchilus, 324
 Myrmotherula, 322
 mystacalis, Diglossa, 368
 mystacea, Oreopeleia, 95
 mystaceus, Platyrinchus, 348
 Mytalina, 266
 Mytilus, 184

 nana, Cephalodella, 258
 Lecane, 264
 Nassarius, 214
 naumanni, Testudinella, 271
 neglectum, Todirostrum, 349
 neglectus, Hipposideros, 116
 nelitis, Cephalodella, 258
 nemorivaga, Eumastacops, 68
 Nemosia, 377
 Neopelma, 356
 Nephocetes, 96
 Nesophlox, 97
 Neothraupis, 378
 newtoni, Otus, 95
 niadicus, Pteropus, 114
 niasensis, Arctictis, 123
 Myotis, 118
 niasis, Tragus, 162
 nicotianae, Callosciurus, 138
 niger, Nephocetes, 96
 nigricans, Ridgwayornis, 352
 nigricipes, Turdus, 363
 nigrirostris, Arremon, 389
 nigro-cincta, Calliste, 373
 nigro-maculata, Phlegopsis, 327
 nigro-rufa, Spemophila, 384
 niobe, Lariscus, 141
 niothis, Lecane, 264
 niveiceps, Colonia, 342
 nodosa, Lecane, 264
 Nothola, 266
 notius, Basileuterus, 371
 Notommatia, 266
 nubilus, Presbytis, 130
 Nucula, 180
 nudipes, Mustela, 119
 Numenius, 105
 Numida, 92
 Nycticebus, 126
 Nycticorax, 105
 Nyroca, 105
 nyssa, Resticula, 269

 oblonga, Synchaeta, 270
 obscura, Elaenia, 353
 Spermophila, 383
 Thraupis, 375
 obscurata, Lochmias, 336
 obscurior, Myiozetetes, 345
 obscurum, Todirostrum, 349
 obsoletus, Xenops, 335

 Xiphocolaptes, 336
 obtusa, Colurella, 259
 Lecane, 264
 occidentalis, Pelecanus, 90
 Tersina, 371
 Tupaia, 111
 occipitalis, Muscisaxicola, 339
 ochraceiventris, Myiophobus, 347
 ochrasceus, Spermophila, 384
 ochrogaster, Phylidor, 335
 ochrogyna, Hypocnemis, 326
 ochrolaemus, Automolus, 335
 Ochthodiaeta, 341
 Ochthoeca, 341
 Ochthornis, 344
 oenanthoides, Ochthoeca, 341
 ohioensis, Lecane, 264
 oleaginea, Syndactyla, 335
 Oliva, 216
 olivacea, Piranga, 376
 olivaceus, Dendrocolaptes, 336
 Mitrephanes, 347
 Spinus, 386
 Vireo, 367
 olivascens, Embernagra, 391
 Sicalis, 387
 olivina, Schistochlamys, 378
 Onychorhynchus, 348
 opias, Lecane, 264
 orbignyianus, Onychorhynchus, 348
 orbitalis, Pogonotriccus, 350
 oreas, Lessonia, 341
 Oreomanes, 370
 Oreopeleia, 95
 Oreopsar, 381
 ornata, Proales, 269
 Trichocerca, 272
 ornatus, Cephalopterus, 359
 Ornithion, 355
 Orochelidon, 365
 oryzivorus, Dolichonyx, 351
 Psomocolax, 379
 Oryzoborus, 385
 Ostrea, 187
 ottonis, Pogonotriccus, 350
 Otus, 95
 ovalis, Chromogaster, 259
 Lepadella, 265
 ovata, Rotaria, 274
 ovoides, Acteon, 221
 Oxyechus, 104
 oxysternon, Lophocharis, 266
 Oxyura, 104

 Pachyramphus, 358
 pachyura, Notommatia, 267
 Paguma, 122
 palimmeka, Proales, 269
 pallascens, Contopus, 346

 Dendrocolaptes, 336
 Tolmomyias, 348
 palliata, Ratufa, 142
 pallida, Deconychura, 338
 Diglossa, 369
 Lindia, 266
 Upucerthia, 329
 pallidiceps, Muscisaxicola, 340
 pallidigula, Cypsnagra, 377
 pallidior, Hirundinea, 347
 pallidus, Myiotheretes, 341
 palmarum, Thraupis, 375
 paludosa, Keratella, 262
 panarista, Cephalodella, 258
 Panopea, 201
 Paradoxurus, 122
 paraguayensis, Nemosia, 377
 Paraspheena, 290
 parasita, Proales, 269
 parasitica, Cephalodella, 258
 parilis, Glycymeris, 183
 Saxicava, 201
 parishii, Eumastacops, 81
 Paroaria, 383
 parva, Eulachnis, 262
 Testudinella, 271
 parvula, Notommatia, 267
 parvirostris, Elaenia, 353
 passa, Filinia, 262
 Passer, 381
 patagonica, Pygochelidon, 365
 patella, Lepadella, 265
 patina, Testudinella, 271
 patulus, Platyras, 267
 patuxentium, Cardium, 193
 pax, Cyclarhis, 367
 Pecten, 185
 pectinata, Synchaeta, 270
 pectoralis, Habrura, 351
 Poospiza, 391
 Pedalia, 267
 pedeis, Lecane, 264
 Pedipartia, 267
 pedunculata, Floscularia, 262
 pelatis, Lecane, 264
 Pelecanus, 90
 peligica, Epiphanes, 261
 pelzelni, Myiarchus, 346
 Sicalis, 387
 Tityra, 359
 pensylvanica, Dendroica, 105
 peracuta, Tellina, 199
 peralta, Periploma, 202
 percrassa, Ostrea, 188
 peregrinus, Falco, 106
 perexigua, Erato, 211
 peridia, Notommatia, 267
 Periploma, 202
 periporphyrus, Icterus, 380

- Perissotriccus, 350
 perplana, Astarte, 189
 perplexa, Lecane, 264
 perspicillata, Hymenops, 343
 pertica, Lecane, 264
 peruviana, Leptasthenura, 330
 peruvianus, Dendroplex, 337
 Leptopogon, 355
 Myiobius, 347
 Phacellodomus, 334
 Sclerurus, 336
 Petaurista, 143
 Petimons, 142
 Petrochelidon, 365
 petromyzon, Pleurotrocha, 267
 Phacellodomus, 334
 Phacoides, 192
 phacus, Proalinopsis, 269
 Phaeomyias, 354
 Phaeoprogne, 365
 Phaeotriccus, 343
 Phaëthon, 90
 phæura, Macaca, 128
 Pheuticus, 383
 Phibalura, 357
 Philodina, 274
 Phleocyptes, 330
 Phlegopsis, 327
 phryganophila, Schoenophylax, 331
 Phrygilus, 387
 Phylidor, 335
 Phylloscartes, 351
 physalis, Cephalodella, 259
 Phytotoma, 359
 piceus, Callosciurus, 136
 piger, Dryobates, 104
 pinus, Mermivora, 105
 Pipra, 356
 Pipraeidea, 372
 Pipreola, 357
 Piprites, 356
 Pipromorpha, 355
 Piranga, 375
 pitangua, Megarhynchus, 345
 Pitangus, 345
 pitiayumi, Compsorthypis, 370
 Pitylus, 382
 pityophila, Dendroica, 102
 plana, Crepidula, 208
 planasuturata, Trigonomastoma, 217
 planera, Cephalodella, 259
 planiceps, Ailurin, 125
 platessa, Trichocerca, 272
 Platycichla, 364
 Platyras, 267
 Platypsar, 358
 Platyrinchus, 348
 plebeja, Enmastacops, 78
 plebejus, Phrygilus, 388
 plebia, Turritella, 204
 plena, Philodina, 274
 Venus, 195
 Pleuretra, 274
 Pleuroliria, 219
 Pleurotroca, 267
 plicata, Cephalodella, 259
 Macrotrachela, 274
 Plicatula, 185
 Ploesoma, 268
 ploenensis, Lecane, 264
 plumbea, Spermothila, 383
 poecilurus, Knipolegus, 343
 poeyi, Masyntes, 49
 Pogonotriccus, 350
 Polinices, 209
 Polioptila, 364
 Polyarthra, 268
 Polyborus, 91
 polycyma, Cymatosyrinx, 218
 polytmus, Trochilus, 97
 polyzonus, Dendrocolaptes, 336
 Pompholyx, 268
 Pongo, 133
 Poospiza, 390
 porcellus, Trichocerca, 272
 Porphyrospiza, 383
 Porzana, 92, 105
 prattii, Haematopus, 94
 precerina, Kurtziella, 219
 Premnoplex, 334
 Presbytis, 129
 presumpta, Lecane, 264
 priodontia, Asplanchna, 267
 prionacis, Dieranophorus, 260
 Proales, 268
 Proalinopsis, 269
 proclastes, Dieranophorus, 260
 producta, Mya, 202
 Tellina, 200
 profundorum, Crassinella, 189
 Progne, 98, 364
 proteus, Balanus, 223
 Protonotaria, 105
 proxima, Nucula, 180
 prunus, Phacoides, 192
 psammophila, Lecane, 264
 pseudeburnea, Cymatosyrinx, 218
 pseudocerberus, Notomata, 267
 Pseudocolaptes, 334
 Pseudocolopteryx, 351
 Pseudocistes, 269
 Pseudoploesoma, 269
 Pseudoseisura, 335
 Pseudotriccus, 350
 Psomocolax, 379
 Psychomastax, 7
 psylla, Psychomastax, 7
 Pteropus, 114
 Ptygura, 269
 pulacayensis, Zonotrichia, 390
 pulchella, Ochthoeca, 342
 pumila, Lecane, 264
 puna, Troglodytes, 361
 puncticeps, Basileuterus, 371
 Thamnophilus, 320
 punctulata, Calliste, 372
 punensis, Asthenes, 333
 Geositta, 328
 Phrygilus, 387
 purpurata, Querula, 359
 pusilla, Trichocerca, 272
 pusillus, Lophospingus, 388
 pycina, Lecane, 264
 pygmaea, Notomata, 267
 Pygchelidon, 365
 pyriformis, Lecane, 264
 Pyriglena, 325
 Pyrocephalus, 343
 pyrrha, Lecane, 264
 Pyrrhomyias, 347
 pyrrhophia, Cranioleuca, 332
 pyrrhopterus, Icterus, 380
 quadricarinata, Lepadella, 265
 quadricornifera, Macrotrachela, 274
 quadricornis, Platyras, 267
 quadridentata, Lecane, 264
 quadridentatus, Brachionus, 257
 Querula, 359
 quinquecostata, Lepadella, 265
 radiatus, Thamnophilus, 320
 ralloides, Myadestes, 364
 Rallus, 105
 Ramphocelus, 375
 Ramphotrigon, 349
 Rapana, 211
 Rattus, 144
 rattus, Trichocerca, 272
 Ratufa, 142
 reclusa, Habrotrocha, 274
 regalis, Pipra, 356
 remanei, Cephalodella, 259
 remota, Dendrocincla, 339
 Reticula, 269
 reticulatoides, Cancellaria, 217
 retrocitta, Melanella, 205
 retropinna, Squatinella, 270
 rex, Troglodytes, 361
 Rhinolophus, 116

- rhomboides, *Lepadella*, 265
Rhynchoecylus, 349
 rhytida, *Lecane*, 264
Rhytipterna, 357
 richardsoni, *Contopus*, 346
Ridgwayornis, 352
 ringens, *Floscularia*, 262
Riparia, 365
 riparia, *Riparia*, 365
 rixosa, *Machetornis*, 344
 robusta, *Asthenes*, 333
Peurotrocha, 268
Psychomastax, 7
 robustus, *Dicranophorus*, 260
 rosacea, *Piranga*, 376
 rosea, *Trichocerca*, 272
 rossae, *Trichocerca*, 272
 rostrata, *Asthenes*, 333
 rostratus, *Dicranophorus*, 260
Rotaria, 274
 rotatoria, *Rotaria*, 274
 rothschildi, *Cyanocompsa*, 333
 rotifer, *Pseudoeistes*, 269
 rotundata, *Trichocerca*, 272
 roussetleti, *Harringia*, 262
Trichocerca, 272
 rousselleti, 270
 ruandensis, *Parasphenia*, 300
 ruber, *Phacellodomus*, 334
 rubidus, *Oxyechus*, 104
 rubinus, *Pyrocephalus*, 343
 rubra, *Piranga*, 375
Scepanotrocha, 274
 rubro-cristata, *Heliochera*, 357
 rufa, *Casiornis*, 357
Formicivora, 324
Lessonia, 341
 rufescens, *Thamnistes*, 322
 ruficapillus, *Agelaius*, 381
 ruficauda, *Upucerthia*, 329
 ruficaudatus, *Phylidor*, 335
 ruficeps, *Pseudotriccus*, 350
Tanagra, 371
Thlypopsis, 378
Rupicola, 359
 ruficollis, *Spermophila*, 384
Stelgidopteryx, 365
 rufigularis, *Eusearthmornis*, 349
 rufinucha, *Atlapetes*, 389
 rufi-pectoralis, *Oethoeca*, 342
 rufipennis, *Cnemarchus*, 341
Cranioleuca, 332
 rufipes, *Eusearthmornis*, 350
 rufiventris, *Saltator*, 382
Turdus, 363
 rufo-axillaris, *Molothrus*, 379
 rufus, *Platyparis*, 358
 Russa, 162
 russeola, *Certhiaxis*, 332
 rusticus, *Spodiornis*, 388
 sabulosa, *Cephalodella*, 259, 276
 saccigera, *Notommata*, 267
 saevus, *Dicranophorus*, 260
 saginata, *Lecane*, 264
 saltans, *Ascomorpha*, 257
Saltator, 382
Saltatricula, 391
 salvini, *Gymnophithys*, 327
 samaipatae, *Synallaxis*, 331
 sanctaemariae, *Cymbilaimus*, 320
 sanctae-crucis, *Spinus*, 385
Satrapa, 344
 saturata, *Rupicola*, 359
 satyrus, *Lecane*, 265
 saundersiae, *Encentrum*, 261
 saurus, *Temnomastax*, 13
 savarti, *Acanthodesia*, 179
 Saxicava, 201
 sayana, *Oliva*, 216
 Sayornis, 342
Scalaria, 206
 scalarispira, *Busycon*, 214
 Scardium, 270
Scepanotrocha, 274
Schiffornis, 356
 scipio, *Trichocerca*, 273
 schistacea, *Spermophila*, 383
 schistaceus, *Thamnophilus*, 321
Schistochlamys, 378
 schistogynus, *Thamnomanes*, 322
Schizoeaca, 331
 selateri, *Cercomacra*, 325
Xanthomyias, 354
Sclerurus, 336
Schoeniophylax, 331
 schoenobaenus, *Phleocyptes*, 330
 schrankii, *Calliste*, 372
 scutata, *Lecane*, 265
Scytalopus, 319
 secta, *Turritella*, 204
 seiboldii, *Asplanchna*, 257
 Seila, 206
 selenura, *Taphrocampa*, 270
 Semele, 199
 senex, *Platyrinchus*, 348
 Serpophaga, 352
 serranus, *Turdus*, 363
 serrirostris, *Tanagra*, 371
 setiger, *Rattus*, 153
 sharpei, *Terenura*, 325
 shilohensis, *Acteon*, 221
Balanus, 223
Cancellaria, 217
Diplodonta, 191
Muricea, 211
Sicalis, 386
 signata, *Pipreola*, 357
 signatus, *Thamnophilus*, 320
 signifera, *Lecane*, 265
 silpha, *Notommata*, 267
 similis, *Lepadella*, 265
Myiozetetes, 345
Rattus, 155
Saltator, 382
Trichocerca, 273
Trichotria, 273
 simonsi, *Scytalopus*, 319
 Simoxenops, 335
 simplex, *Anomia*, 187
Pseudotriccus, 350
 sinaria, *Nucula*, 180
 sincipitalis, *Phacellodomus*, 334
Sinatherina, 270
 Sinum, 210
Siphonalia, 213
Sirystes, 344
Sittasomus, 338
 sittoides, *Diglossa*, 368
Smaragdolanus, 367
 smithsonianus, *Larus*, 105
Solarium, 205
 solitaria, *Tringa*, 105
 solitarius, *Archiplanus*, 379
Myiodynastes, 345
 solitudinis, *Buteo*, 91
 sophiae, *Calliste*, 372
 sopora, *Nassarius*, 215
 sordida, *Proales*, 269
Rotaria, 274
Thlypopsis, 377
 sordidum, *Conirostrum*, 369
 spadiceus, *Atila*, 357
Spatula, 105
 speciosa, *Ateleodaenis*, 369
 spectabilis, *Elaenia*, 352
 speculifera, *Diuca*, 387
 Speotyto, 95
Spermophila, 383
Spinus, 385
 spixii, *Pachyramphus*, 358
 spodiopota, *Oethoeca*, 342
 spodiops, *Eusearthmornis*, 349
Spodiornis, 388
Sportella, 191
 squamigera, *Margarornis*, 334
 squamipes, *Proailnopsis*, 269
Squatina, 270
 staminea, *Antigona*, 194
 Area, 181
 staurus, *Proailnopsis*, 269
 steinbachi, *Schiffornis*, 356
 stejnegeri, *Spinus*, 386
Stelgidopteryx, 365
Stephanoceros, 270
Sterna, 95
 stichaea, *Lecane*, 265
 stictonotus, *Premnoplex*, 334
 sticturus, *Thamnophilus*, 321
 Stigmatura, 352
 stipitata, *Keratella*, 262
 stitista, *Notommata*, 267

- stokesii, Lecane, 265
 strepera, Elacnia, 353
 strepta, Cephalodella, 259
 Streptognatha, 270
 striaticeps, Cranioleuca, 332
 Entotricus, 343
 Phacellodomus, 334
 striaticollis, Mionectes, 355
 striatus, Simoxenops, 335
 strictifrons, Icterus, 380
 sturninus, Oreomanes, 370
 stylata, Synchaeta, 270
 styrax, Lecane, 263
 subalveata, Lithophaga, 184
 subseriata, Serpophaga, 352
 subfasciatus, Thamnophilus, 322
 subflexuosum, Glyphostoma, 219
 subinsignis, Catamenia, 384
 sublegatus, 353
 submercenaria, Venus, 195
 subquadratus, Macrochaetus, 266
 subrostrata, Arca, 181
 subsecunda, Cephalodella, 259, 276
 subsimilis, Tolmomyias, 348
 subtilis, Lecane, 265
 subtroquata, Corythopsis, 319
 subulata, Lecane, 265
 Suiriri, 353
 suiriri, Suiriri, 353
 Sula, 90
 sula, Sula, 90
 sulcata, Colurella, 259
 Trichocerca, 273
 sulphureiventer, Neopelma, 356
 sumatrae, Thecurus, 159
 sumatrana, Felis, 124
 sumatrensis, Didermocerus, 161
 superciliaris, Leistes, 381
 Sus, 160
 suspicax, Myrmorchilus, 324
 swainsoni, Hylocichla, 364
 swainsonii, Limnodynastes, 105
 swalesi, Turdus, 99
 symmetrica, Astarte, 189
 Symphalangus, 132
 Synallaxis, 331
 Synchaeta, 270
 Syndactyla, 335
 syndactylus, Symphalangus, 132
 Tachuris, 351
 Tachyphonus, 376
 tachyphora, Cephalodella, 259
 taeniopterus, Mecocerculus, 352
 tamalpaisensis, Morseia, 8
 Tanagra, 371
 tantilla, Cephalodella, 259
 tapanulius, Callosciurus, 139
 Taphrocampa, 270
 Taraba, 320
 tardigrada, Rotaria, 274
 tarijae, Cyclarhis, 368
 taripensis, Myospiza, 390
 tavarae, Dysithamnus, 322
 Tanagra, 372
 taurocephala, Keratella, 262
 tecta, Keratella, 262
 Tellina, 199
 telmata, Notommata, 267
 temminckii, Felis, 125
 Temnomastax, 9
 tenella, Brycella, 257
 tenuior, Cephalodella, 259
 Lecane, 265
 Trichocerca, 273
 tenuirostris, Charadrius, 104
 Geositta, 328
 tenuiseta, Lecane, 265
 Terebra, 220
 terebrata, Triphora, 206
 Terentriceus, 347
 Terenura, 325
 Tersina, 371
 tertia, Synallaxis, 332
 tessellata, Colurella, 259
 Testudinella, 270
 tetractis, Trichotria, 273
 tetradon, Mnioba, 274
 Tetrastichus, 271
 Thalasseus, 95
 thalera, Lecane, 265
 Thamnistes, 322
 Thamnomanes, 322
 Thamnophilus, 320
 Thecurus, 159
 thomasi, Astarte, 188
 thopica, Notommata, 267
 thoracica, Oethoeca, 342
 Thlypopsis, 377
 Thraupis, 375
 Thripadectes, 335
 Thripophaga, 334
 Thryothorus, 361
 thura, Pleurotrocha, 268
 thysanus, Dicranophorus, 260
 Tiaris, 103
 tigris, Temnomastax, 27
 Trichocerca, 273
 tilcare, Saltator, 382
 tithasa, Notommata, 267
 titicaca, Geositta, 328
 Tityra, 359
 tobyhannaensis, Encentrum, 261
 Todirostrum, 349
 Tolmomyias, 348
 torquata, Poospiza, 391
 torquatus, Atlapetes, 389
 Thamnophilus, 322
 tortuosa, Trichocerca, 273
 Tragulus, 162
 tremula, Synchaeta, 270
 triacanthum, Ploesoma, 268
 triangularis, Notommata, 267
 triba, Lepadella, 265
 Trichocerca, 271
 Trichothraupis, 377
 Trichotria, 273
 tricolor, Alcedo, 343
 Furnarius, 328
 tricornata, Euphonia, 211
 tridentata, Squatinella, 270
 trifasciatus, Microspingus, 378
 trifida, Eumastacops, 65
 trigla, Polyarthra, 268
 Trigonostoma, 217
 trilineatum, Solarium, 205
 trilobata, Collothea, 259
 Tringa, 105
 Triphora, 206
 triptera, Lepadella, 265
 tripus, Notommata, 267
 triseriata, Polinices, 209
 triurus, Mimis, 362
 trivittatus, Nassarius, 214
 Trochilus, 97
 Troglodytes, 98, 361
 truncata, Lintia, 266
 Trichotria, 273
 truncatum, Ploesoma, 268
 tryphaea, Eothinia, 261
 tryphema, Lecane, 265
 tryphina, Albertia, 257
 tschegrava, Hydroprogne, 105
 tuberculatum, Busycon, 214
 tuberculifer, Myiarchus, 346
 tueumanus, Phrygilus, 388
 tullneri, Calliostoma, 203
 tuomeyi, Polinices, 210
 Tupaia, 111
 Turbonilla, 206
 Turdus, 99, 362
 Turritella, 203
 Tylotrocha, 273
 Tyranniscus, 354
 Tyrannulus, 355
 tyrannulus, Myiarchus, 345
 tyrannus, 98, 105, 344
 tyrannus, Muscivora, 344
 Tyrannus, 105, 344
 Tyto, 95
 tzitzihua, Anas, 105
 ultima, Pleuroliria, 219
 unca, Eumastacops, 60
 uncinata, Trichocerca, 273

- uncinatus, Diceranophorus, 260
 unguolata, Lecane, 265
 unicolor, Heleodytes, 361
 unicornis, Conochilus, 260
 unirufa, Pseudoseiura, 335
 Upucerthia, 329
 urceolaris, Brachionus, 257
 uropygialis, Chircocylla, 358
 Sicalis, 386
 Spinus, 386
 Tyranniscus, 354
 urubambensis, Asthenes, 334
 uvarovi, Parasphena, 300

 vaga, Adineta, 273
 vanefica, Lepadella, 265
 varius, Empidonomus, 344
 velata, Geothlypis, 370
 Ptygura, 269
 Xolmis, 339
 velox, Wierzejskiella, 273
 Venericardia, 191
 venezuelensis, Pipraeidea, 372
 ventralis, Mytalina, 266
 ventripes, Cephalodella, 259
 Venus, 194
 venusta, Notommata, 267
 verecunda, Lecane, 265
 Vermetus, 205
 Vermivora, 105
 vermivorus, Helmitheros, 105
 vernalis, Pleurotrocha, 268
 Trichocerca, 273
 versicolor, Eumastacops, 77
 Lanio, 376

 verticalis, Myioborus, 370
 vestitus, Hylobates, 131
 vicarius, Hipposideros, 117
 vicinior, Myiodynastes, 345
 violaceus, Cyanerpes, 369
 Vireo, 100, 367
 virescens, Butorides, 105
 virginianus, Colinus, 91
 virginica, Ostrea, 187
 viridescens, Basileuterus, 371
 viridicata, Myiopagis, 353
 viridi-cayana, Cyanolyca, 360
 viridiceps, Todiostrostrum, 349
 viridior, Hylophilus, 367
 viridis, Cyclarhis, 368
 Itura, 262
 Monommata, 266
 Pachyramphus, 358
 Sittasomus, 338
 Tersina, 371
 visenda, Lepadella, 265
 vittatus, Sus, 160
 vociferus, Caprimulgus, 105
 Volatinia, 385
 Volvula, 222
 vorax, Cupelopagus, 260

 waggae, Phaemyias, 354
 wagneri, Poospiza, 391
 weberi, Trichocerca, 273
 wetherilli, Acteocina, 221
 whitfieldi, Cymatosyrinx, 218
 Panopea, 201
 Phacoides, 192
 Sportella, 191
 Terebra, 220

 whitfordi, Lepadella, 265
 whitii, Poospiza, 391
 Synallaxis, 332
 Wierzejskiella, 273
 Wilsonia, 105
 wilsonianus, Asio, 105
 wilsonii, Chondrohierax, 90
 withersi, Balanus, 223
 woodi, Fasciolaria, 216
 woolmani, Pecten, 186
 worallii, Elosa, 261

 xanthogastra, Calliste, 372
 Xanthomyias, 354
 Xanthornus, 379
 xanthornus, Myiospiza, 389
 Xanthoura, 360
 xenica, Lepadella, 265
 Xenophora, 209
 Xenops, 335
 Xiphocolaptes, 336
 Xiphorhynchus, 337
 Xolmis, 339

 Yanacea, 351
 yanacensis, Leptasthenura, 330
 yetapa, Gubernetes, 342
 yncas, Xanthoura, 360
 Yoldia, 181
 yungae, Anabacerthia, 335
 Chamaeza, 327
 Spermophila, 384
 yuracares, Gymnostinops, 379

 Zenaida, 104, 105
 zimneri, Scytalopus, 319
 Zonotrichia, 103, 390

GENERAL INDEX

1942

-
- Abstracts of the Minutes of the Proceedings, 393
- Bond, James. Additional Notes on West Indian Birds, 89
- Bond, James, and Rodolphe Meyer de Schauensee. Birds of Bolivia. Part I, 307
- Miller, Gerrit S., Jr. Zoological Results of the George Vanderbilt Sumatran Expedition, 1936-1939. Part V.—Mammals Collected by Frederick A. Ulmer, Jr. on Sumatra and Nias, 107
- Myers, Frank J. The Rotatorian Fauna of the Pocono Plateau and Environs, 251
- Officers Elected, 393
- Rehn, James A. G. Notes on Species of the Locust Genus *Parasphena*, with Descriptions of Three New Species (Orthoptera, Acrididae, Pyrgomorphinae), 287
- Rehn, James A. G., and John W. H. Rehn. A Review of the New World Eumastacinae (Orthoptera, Acrididae).—Part II, 1
- Richards, Horace, and Anne Harbison. Miocene Invertebrate Fauna of New Jersey, 167

SERIAL PUBLICATIONS OF
THE ACADEMY OF NATURAL SCIENCES
OF PHILADELPHIA

Founded 1812

PROCEEDINGS

1841 to date, ninety-three volumes, octavo. Available as a whole only in sales of all Academy serial publications remaining in stock. The majority of the volumes can be supplied at a standard price of \$7.50 each, others, according to scarcity, are available at \$0.35 to \$11.25 each. Price of current volumes \$6.50 to continuing subscribers, \$7.50 to others.

JOURNAL

FIRST SERIES, 1817 to 1842, eight volumes, octavo. Available only in sets of all serials, except certain surplus volumes which can be obtained at \$7.50 to 11.25 per volume.

SECOND SERIES, 1847-1918, sixteen volumes, quarto. Price per volume of 4 parts (where available) \$12.50 to 18.75, per part \$3.75 to 8.00. Volume XV, published complete, issued in commemoration of the Centenary of the Academy, printed on specially prepared paper, 756 pages and 59 plates, 6 of which are colored.

AN INDEX TO THE SCIENTIFIC CONTENTS OF THE JOURNAL AND PROCEEDINGS OF THE ACADEMY 1817-1910. 1433 pages, octavo, \$3.50.

SPECIAL PUBLICATIONS

Number 1. THE MINERALOGY OF PENNSYLVANIA, by SAMUEL G. GORDON. 256 pages, 110 illustrations. \$6.50. Number 2. CRYSTALLOGRAPHIC TABLES FOR THE DETERMINATION OF MINERALS, by V. GOLDSCHMIDT and SAMUEL G. GORDON. 70 pages. \$1.40. Number 3. GABB'S CALIFORNIA CRETACEOUS AND TERTIARY TYPE LAMELLIBRANCHS, by RALPH B. STEWART. 314 pages, 17 plates. \$7.15.

MANUAL OF CONCHOLOGY

A complete, fully illustrated monograph of recent mollusks. By GEORGE W. TRYON, JR., continued by HENRY A. PILSBRY. SERIES I. Cephalopoda, Amphineura and Marine Gastropoda. Seventeen volumes (finished). Volumes I, II, IV and VII out of print. SERIES II. Terrestrial Mollusks. Twenty-eight volumes published. Plain edition, per volume, \$15.00 to \$22.50. Colored edition, per volume, \$20.00 to \$30.00. Fine edition, heavy plate paper, plates in duplicate, colored and India tinted, per volume, \$32.00.

All prices given for "Manual of Conchology" subject to change through scarcity or exhaustion of stock of certain volumes and parts.

MONOGRAPHS

Number 1. THE SCOPHULARIACEAE OF EASTERN TEMPERATE NORTH AMERICA, by FRANCIS W. PENNELL. 650 pages, 43 text-figures and 155 maps. \$5.00. Number 2. THE FISHES OF THE GEORGE VANDERBILT SOUTH PACIFIC EXPEDITION OF 1937, by HENRY W. FOWLER. 349 pages, 13 plates. \$3.50. Number 3. LAND MOLLUSCA OF NORTH AMERICA (NORTH OF MEXICO), by HENRY A. PILSBRY. Volume I, Parts 1 and 2 issued to date. 1004 pages of systematic treatment, 580 text-figures illustrating several thousand shells and anatomical details. Each part with separate index. Volume 2 in preparation. Subscription price to set of two volumes, \$25. Individual sale prices, Volume I: Part 1, \$12; Part 2, \$3; Volume II, \$10.

NOTULAE NATURAE

Composed of papers numbered consecutively, of from 1 to 16 pages. Inaugurated May 1939; 113 numbers published by November 1942. Title page, contents, and index for Nos. 1-100 in preparation. Subscriptions \$3.50 (in advance) for 50 numbers. Individual sale price \$2.50 to \$5.00.

All quotations are net, and not subject to discount.

For further information regarding the cost of specific volumes covered by price ranges quoted above, or for special price-lists of individual, non-serial publications or available separates from the serial publications address:

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA,
Nineteenth and the Parkway, Philadelphia, Penna.

December 1942.

THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

FOUNDED 1812

CLASSES OF MEMBERSHIP

PATRONS: Who contribute or bequeath \$50,000.

BENEFACTORS: Who contribute or bequeath \$10,000.

SUSTAINING MEMBERS: Who contribute or bequeath \$1,000.

ASSOCIATE SUSTAINING MEMBERS: Who contribute or bequeath \$500.

LIFE MEMBERS: Who contribute \$200.

CONTRIBUTING MEMBERS: Who annually contribute \$25.

ANNUAL MEMBERS: Who annually contribute \$10.

NON-RESIDENT MEMBERS: Whose residence or place of business is not within fifty miles of Philadelphia, and who annually contribute \$5.

JUNIOR MEMBERS: Who are under twenty-one years of age when elected, and who annually contribute \$3. Upon reaching twenty-one they may, without re-election, join any other class of membership.

CORRESPONDENTS: Distinguished naturalists living more than thirty miles from Philadelphia.

THE Academy is a Philadelphia institution, maintained wholly by private endowment and contributions from members and friends.

ISBN 978-1-4379-5495-1



9 781437 954951